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Compiled and Edited by LEONARD BRIDGMAN
1953-54



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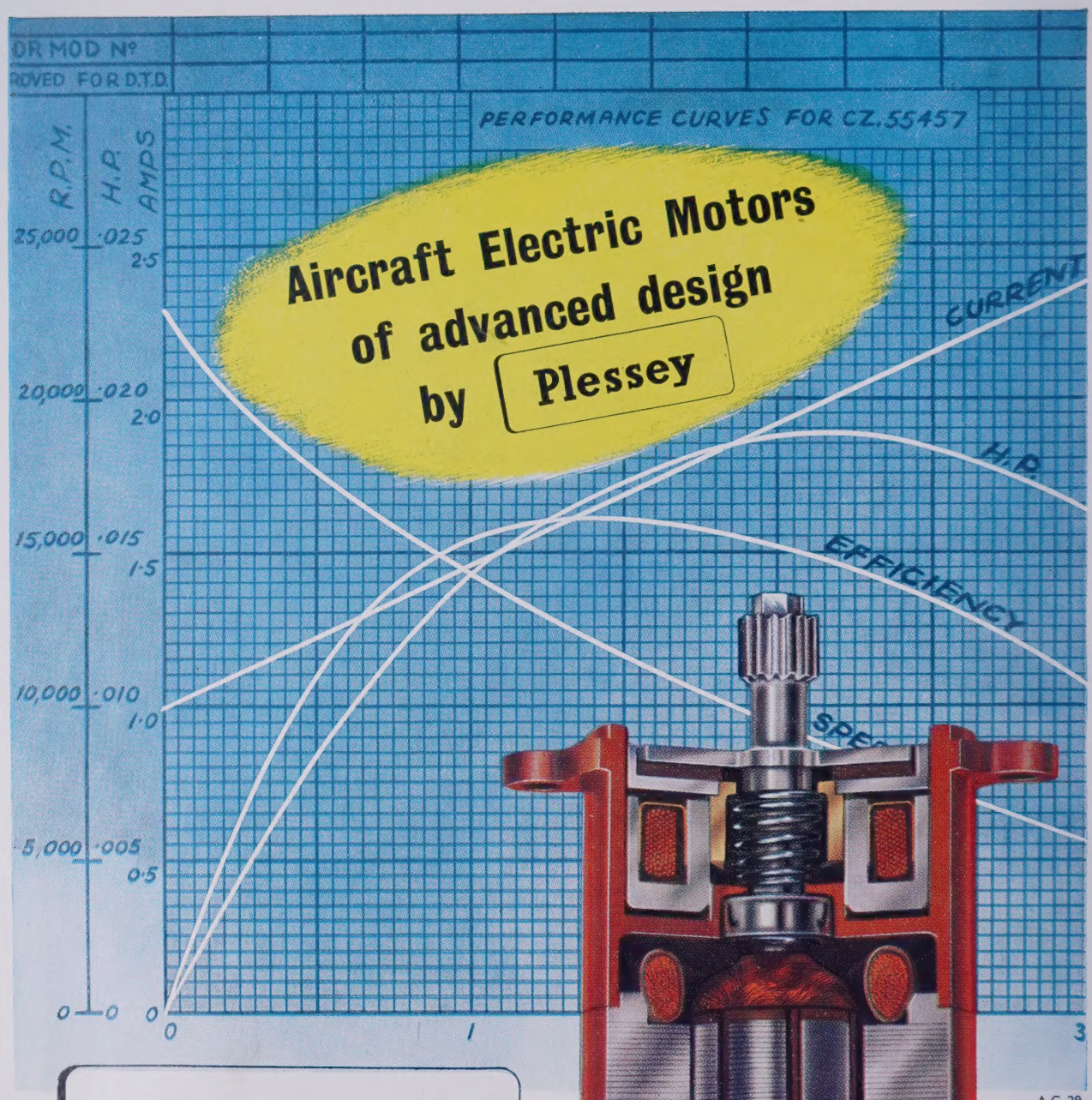
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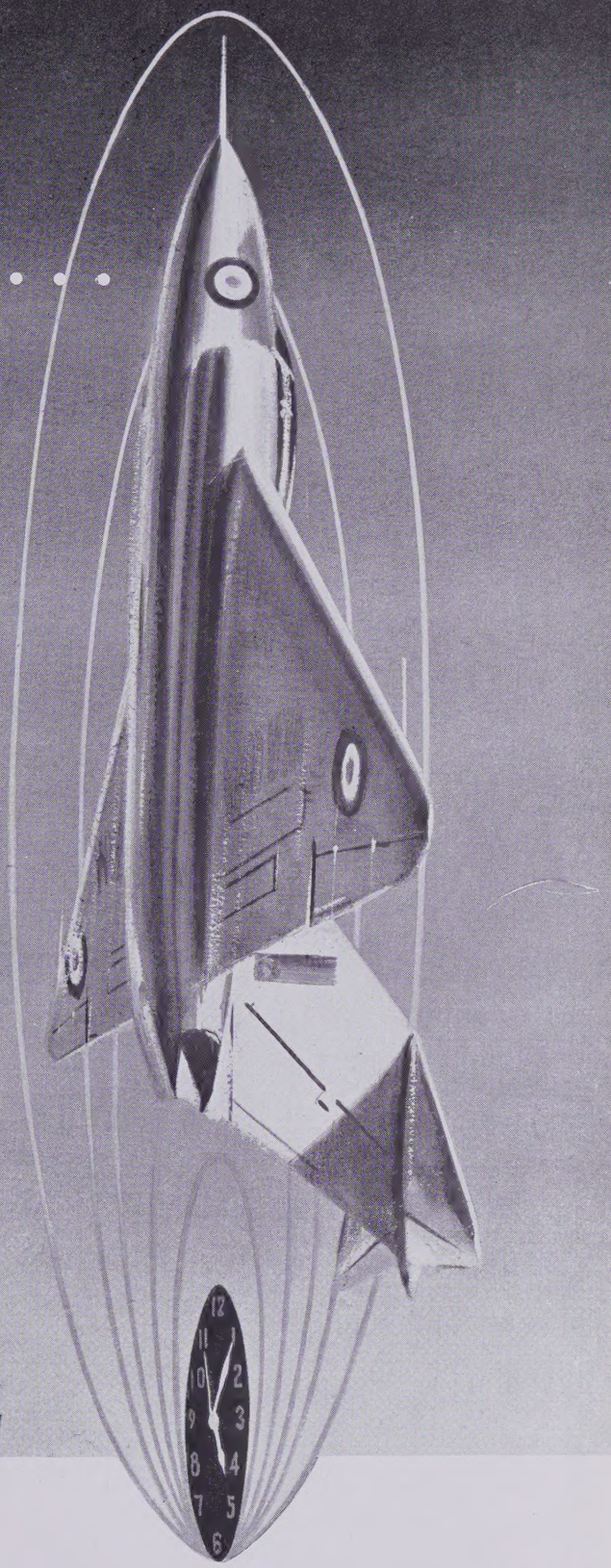
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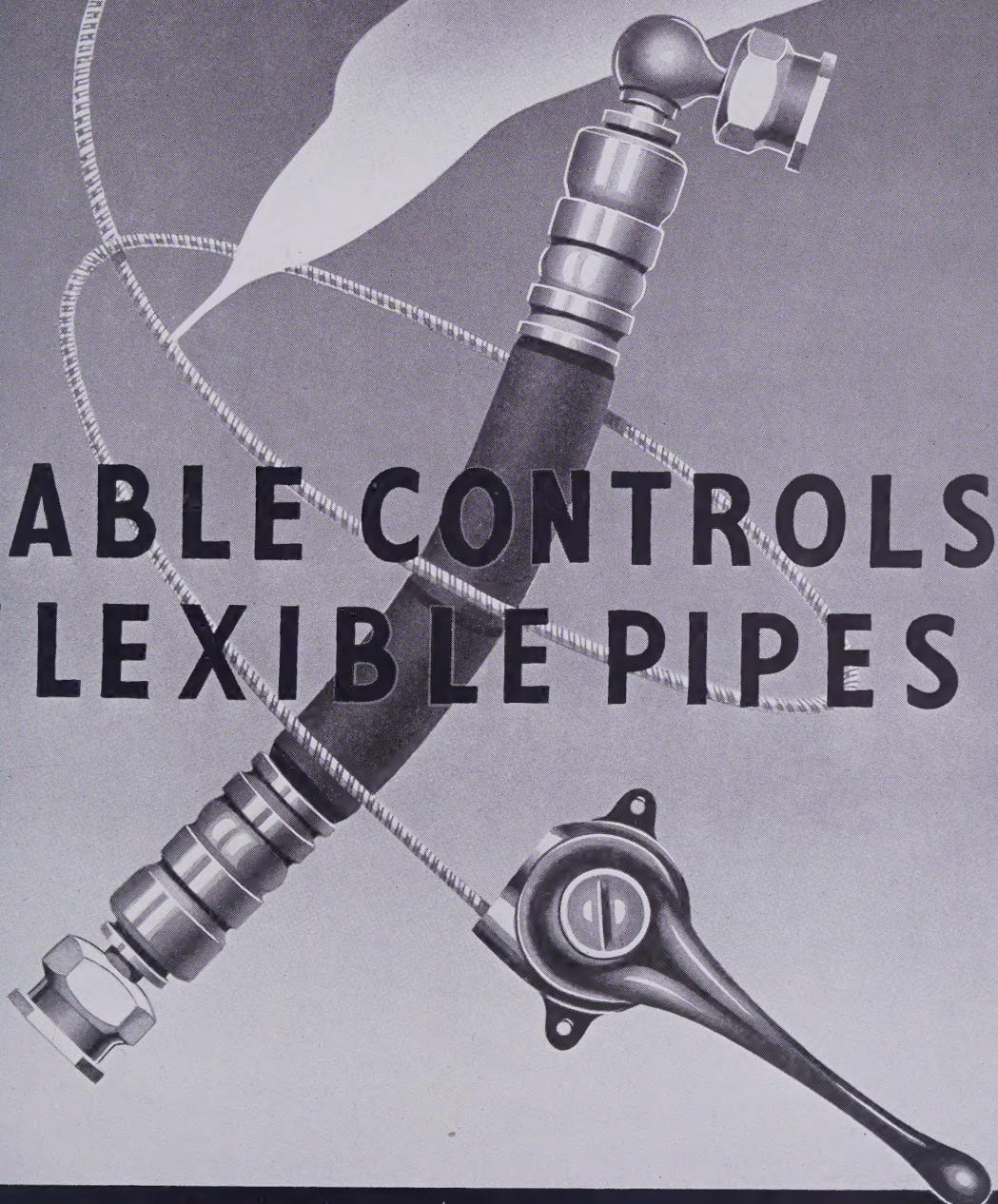
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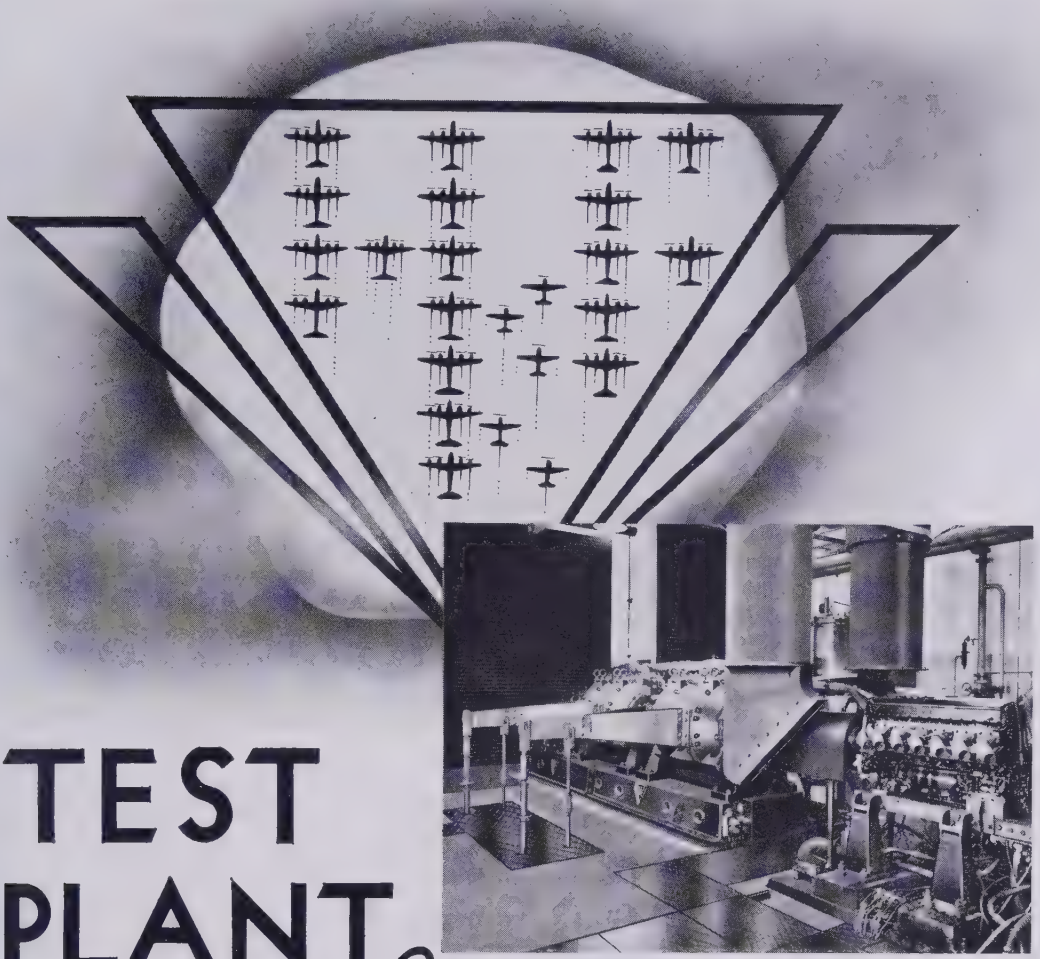
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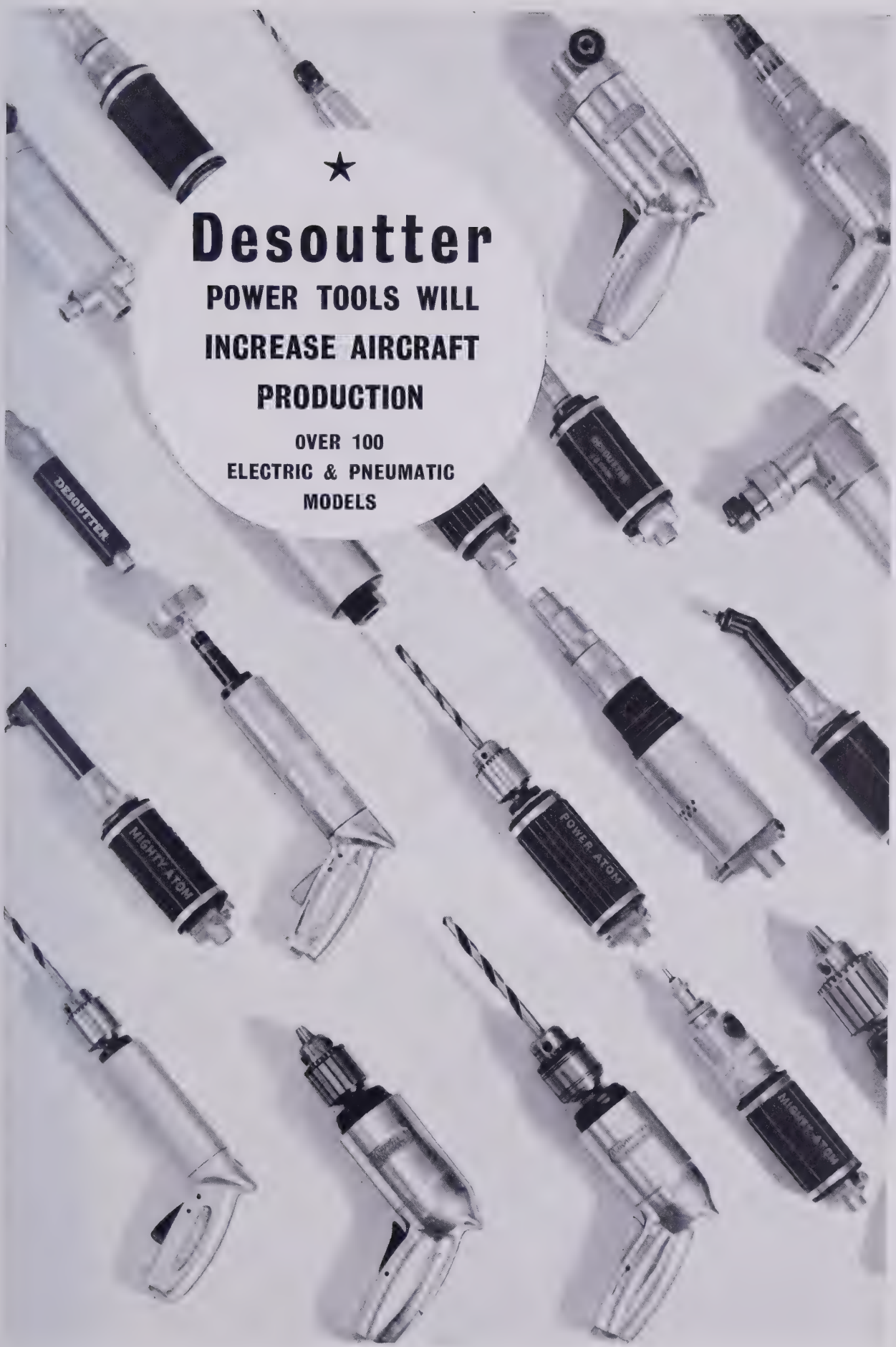
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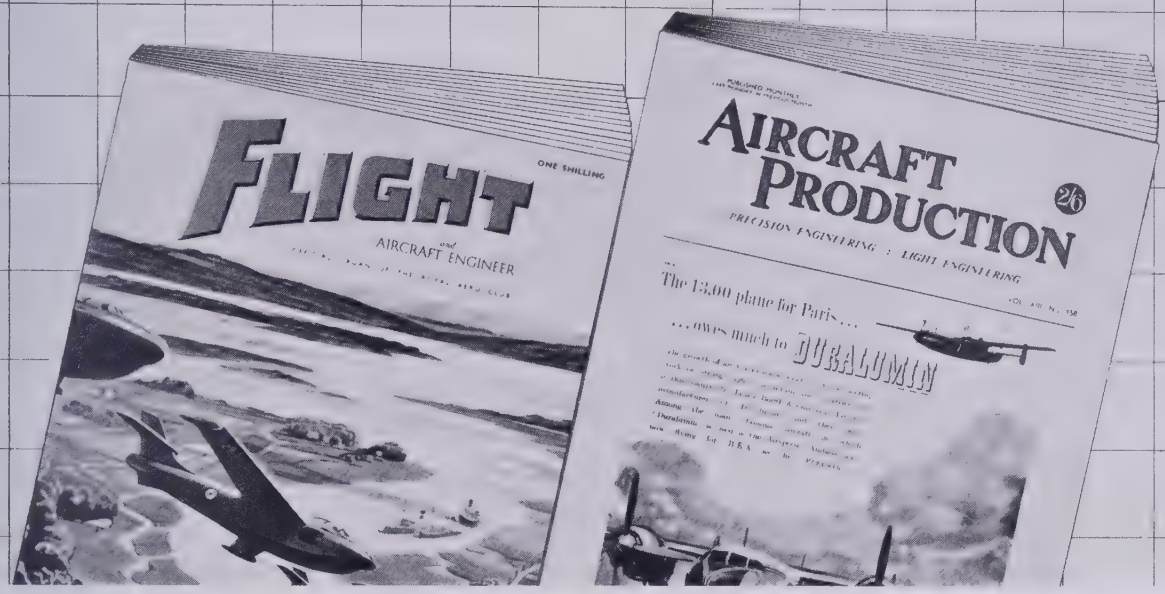
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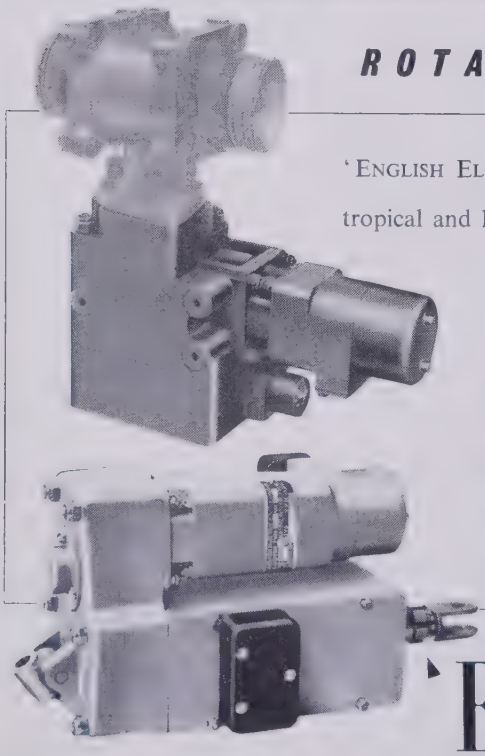
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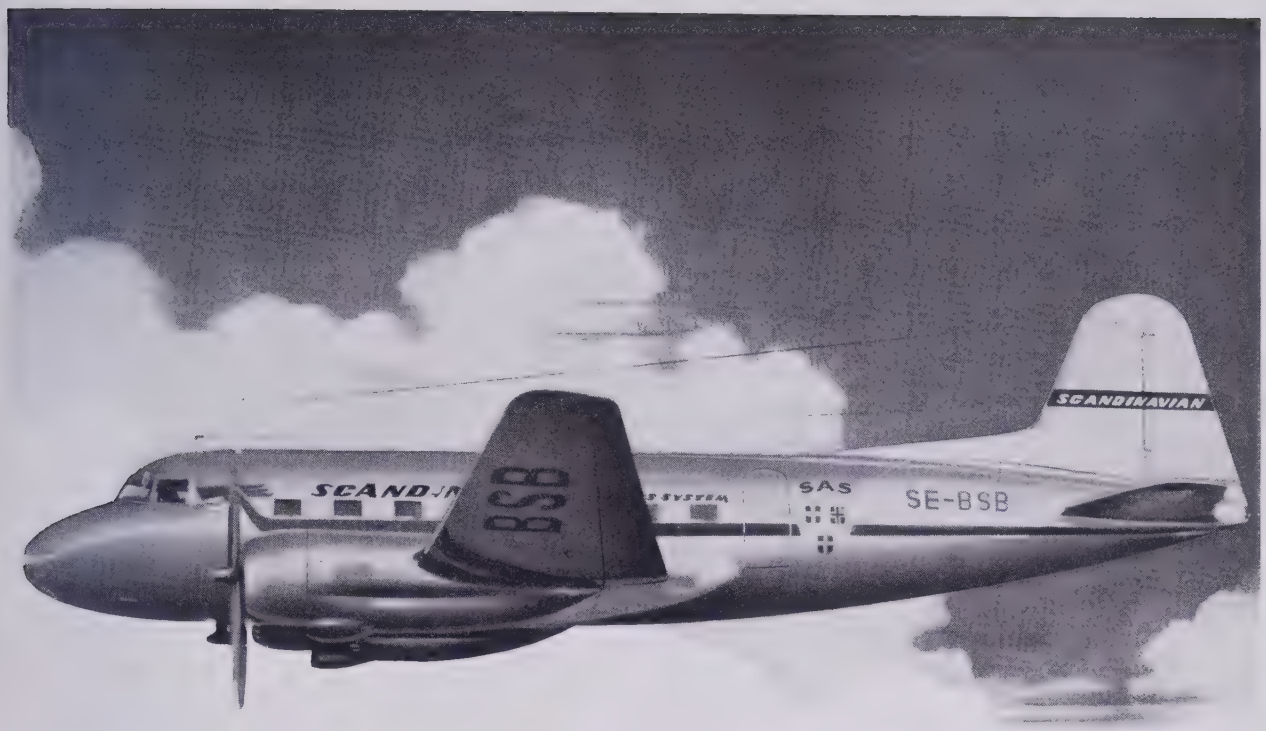
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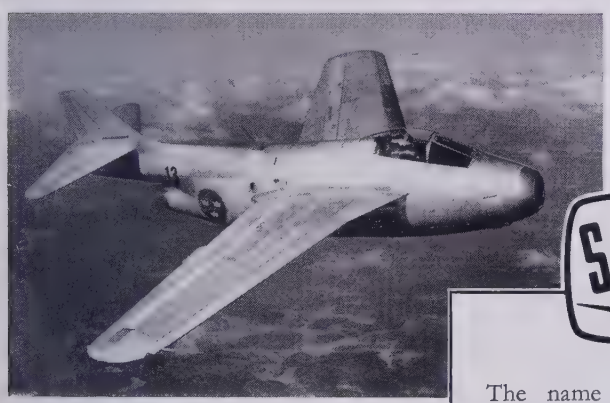
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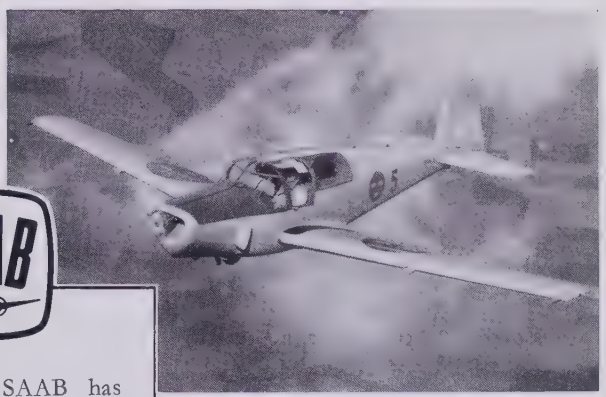


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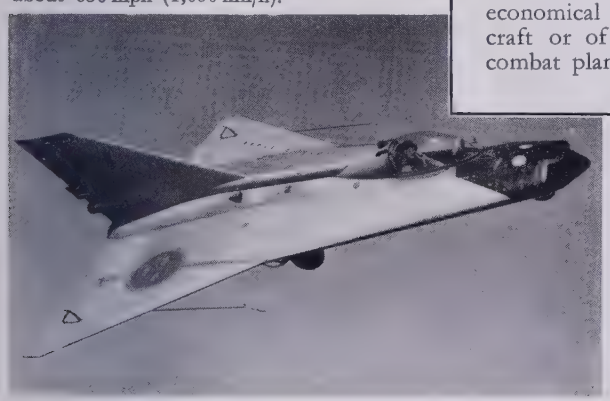
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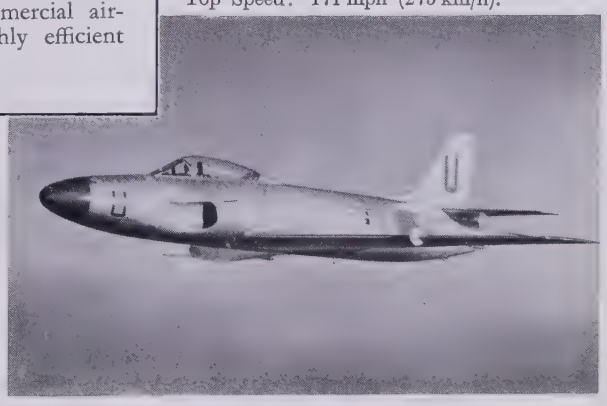
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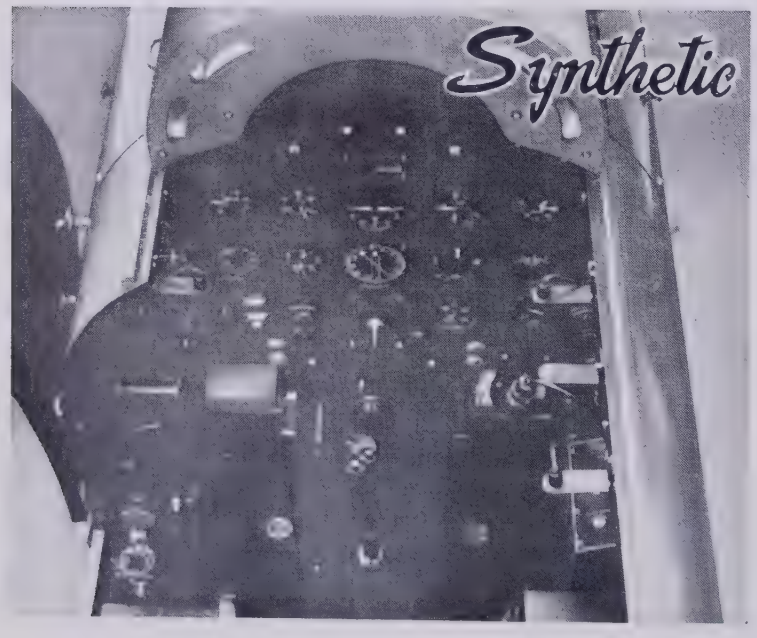
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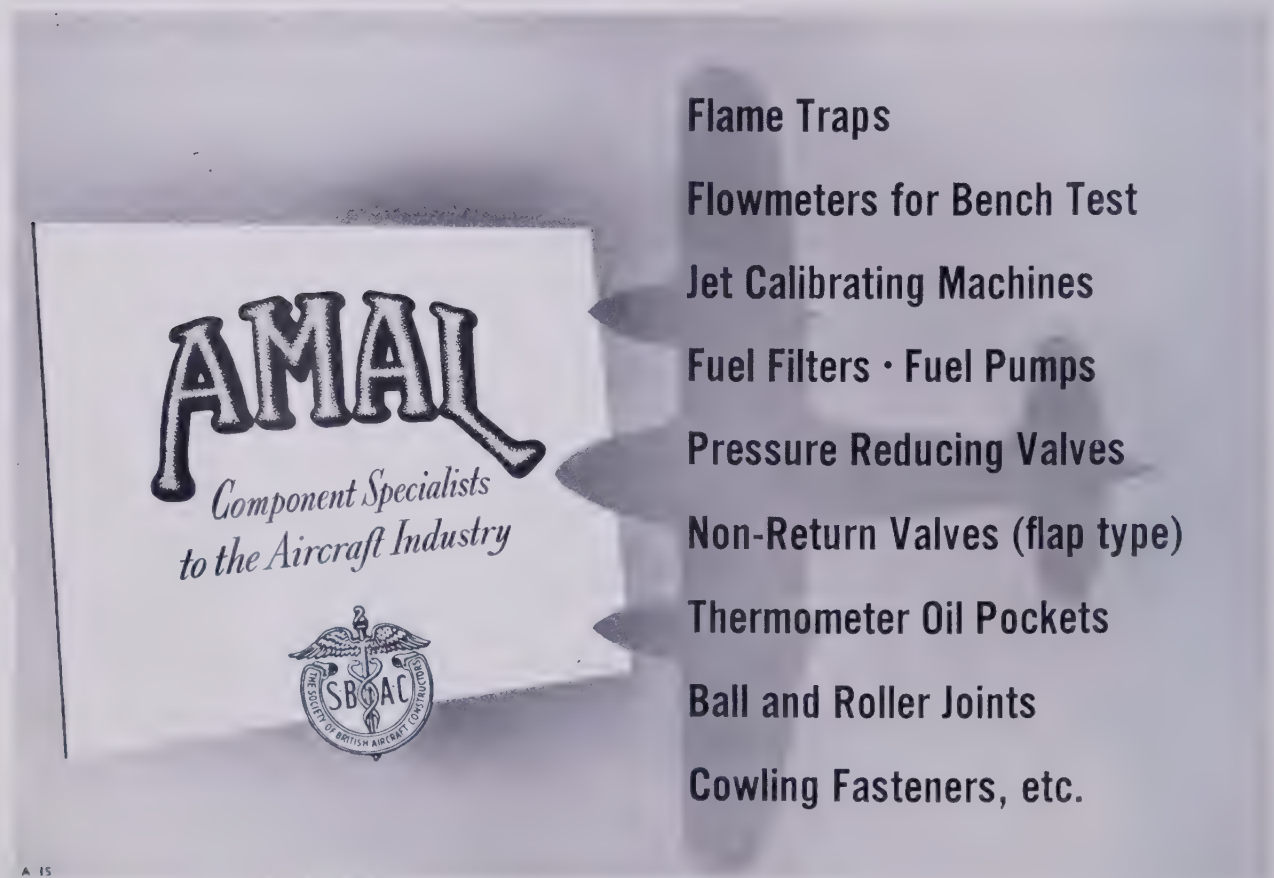
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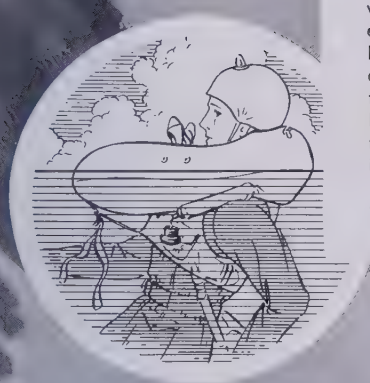
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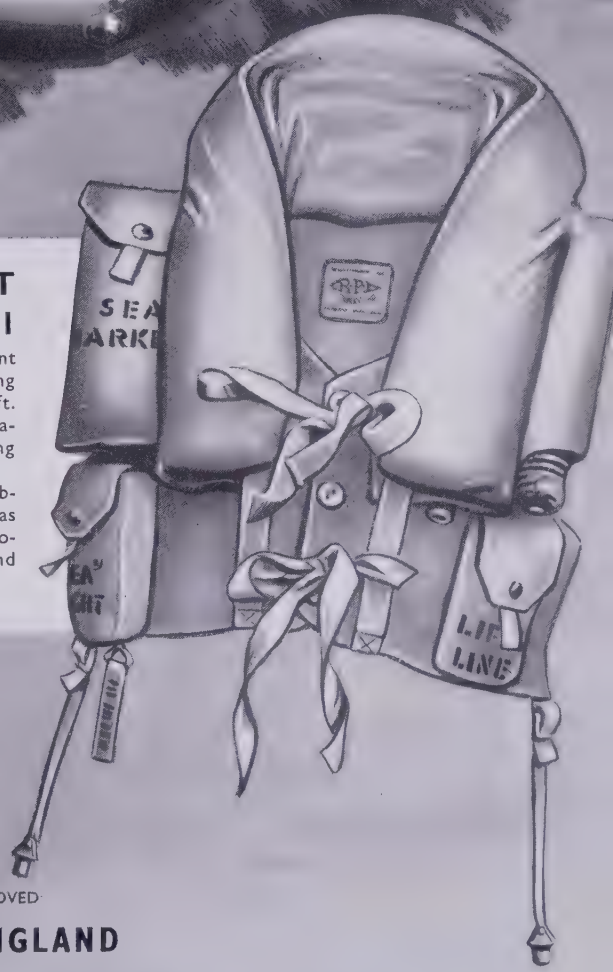
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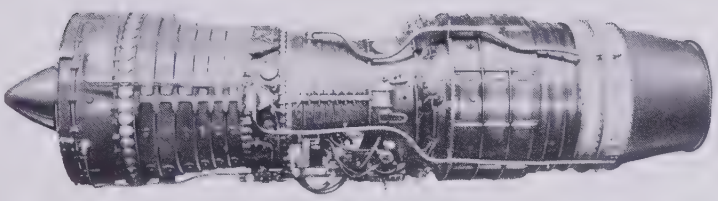
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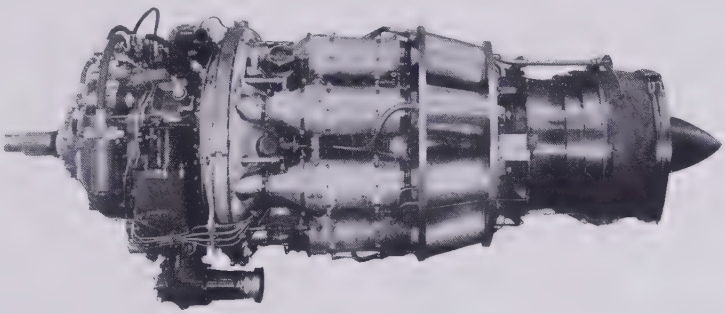
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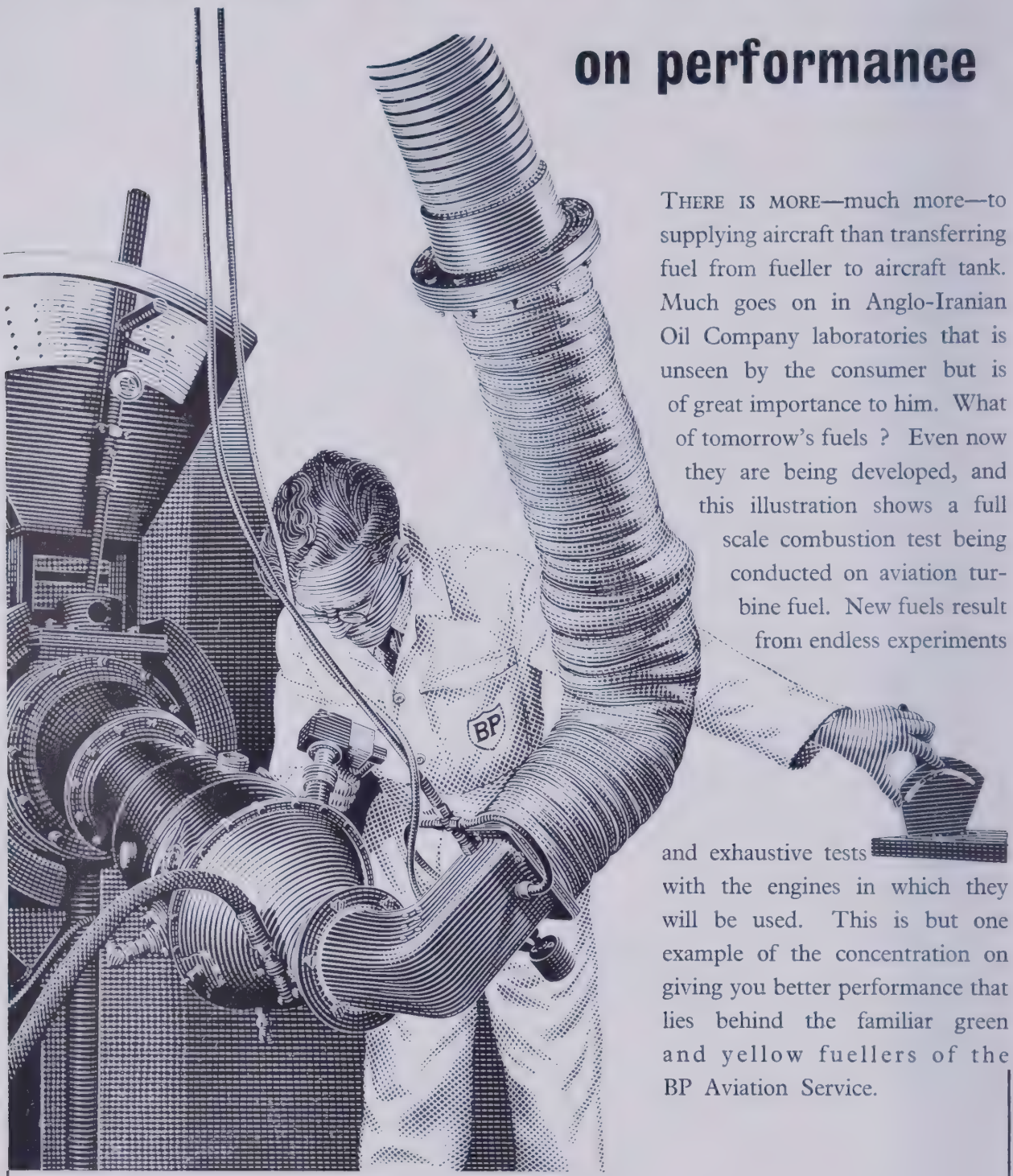
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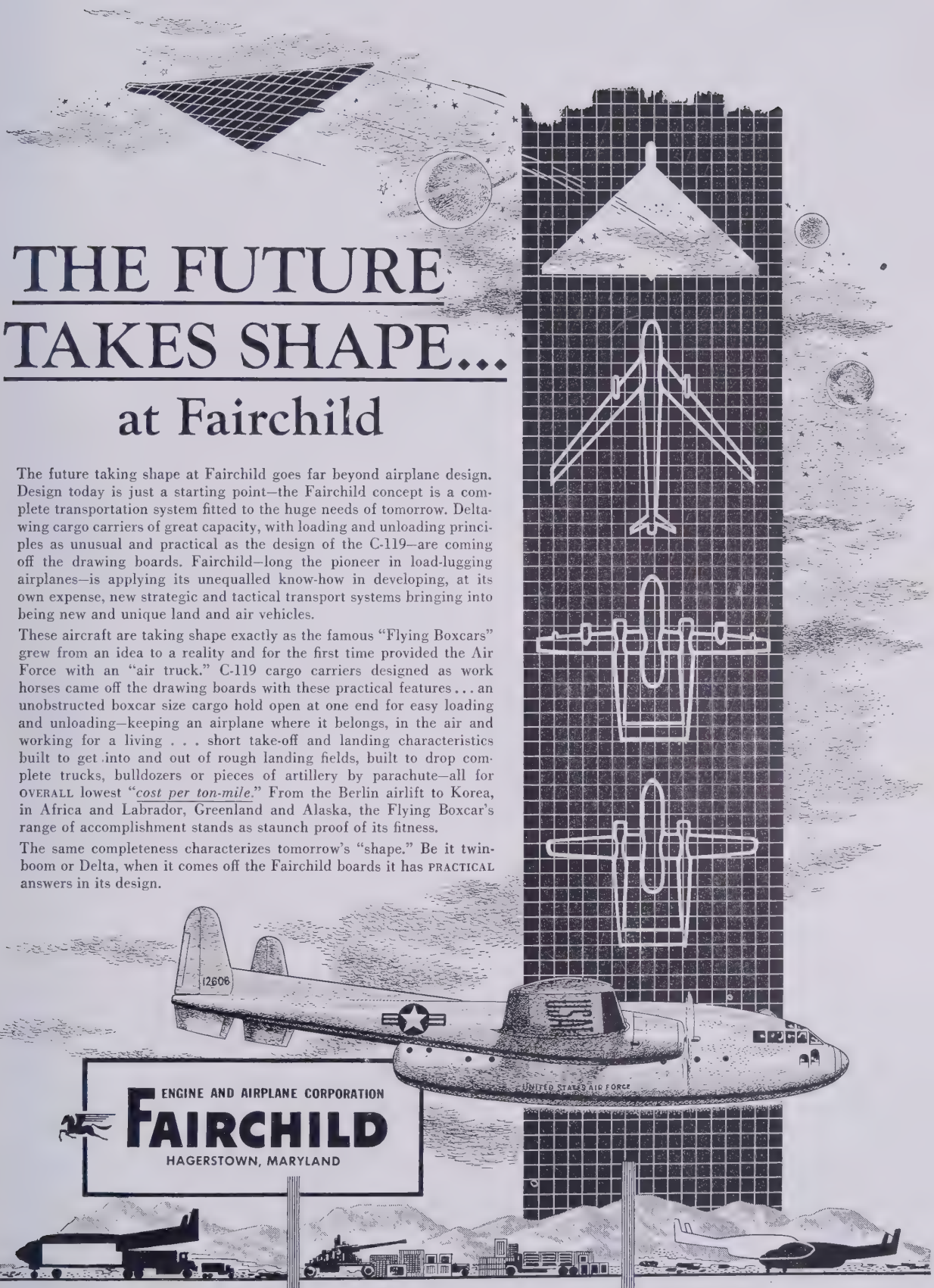
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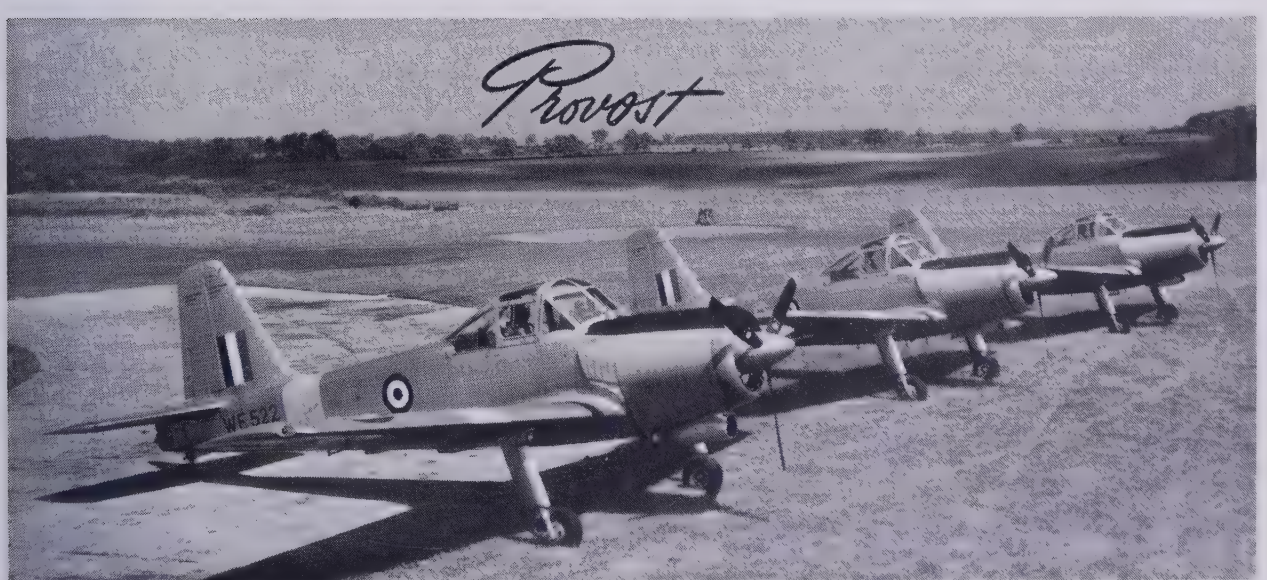
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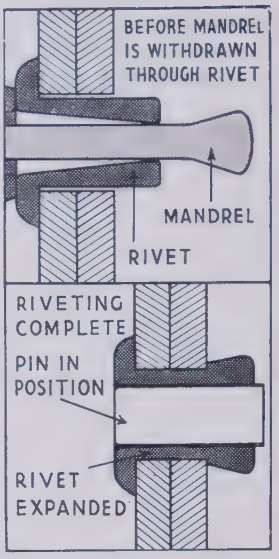
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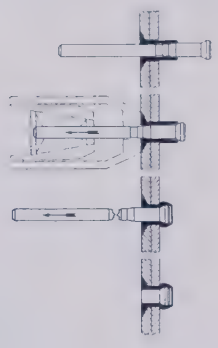


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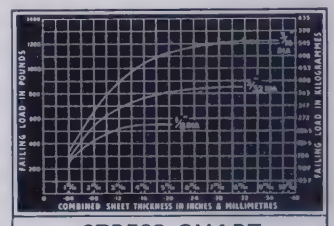
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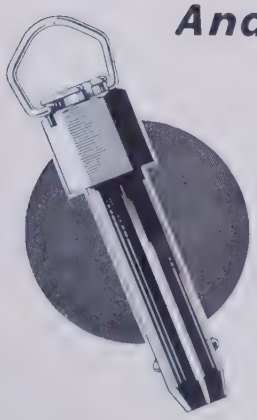
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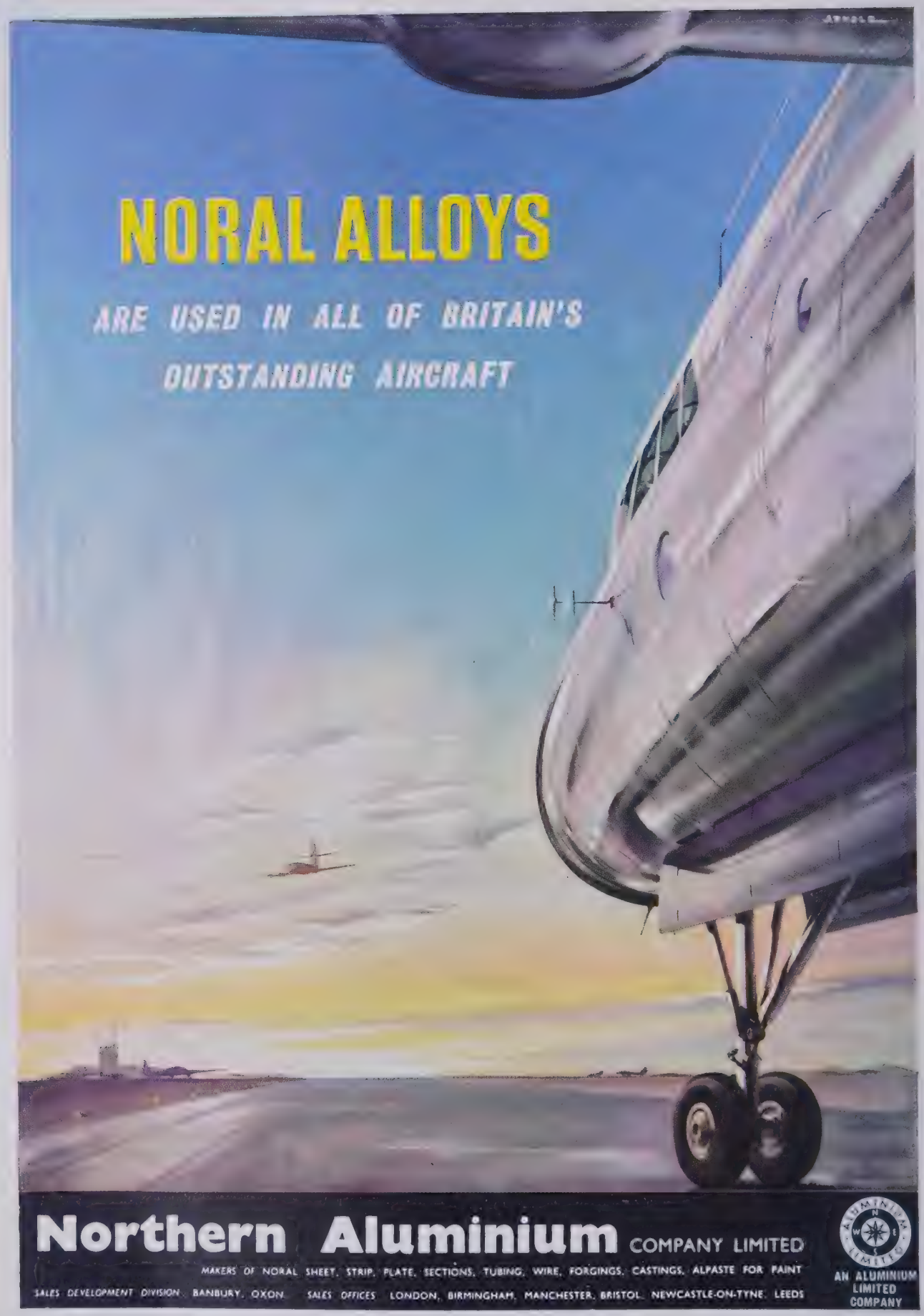
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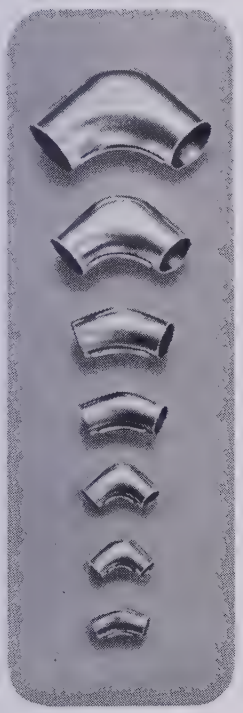
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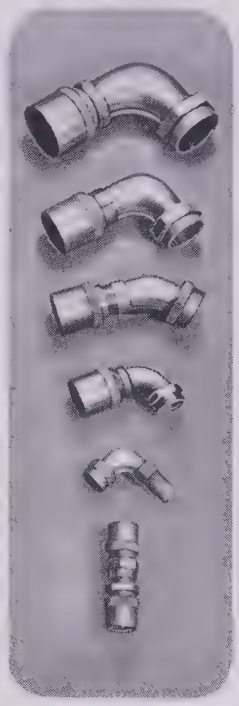
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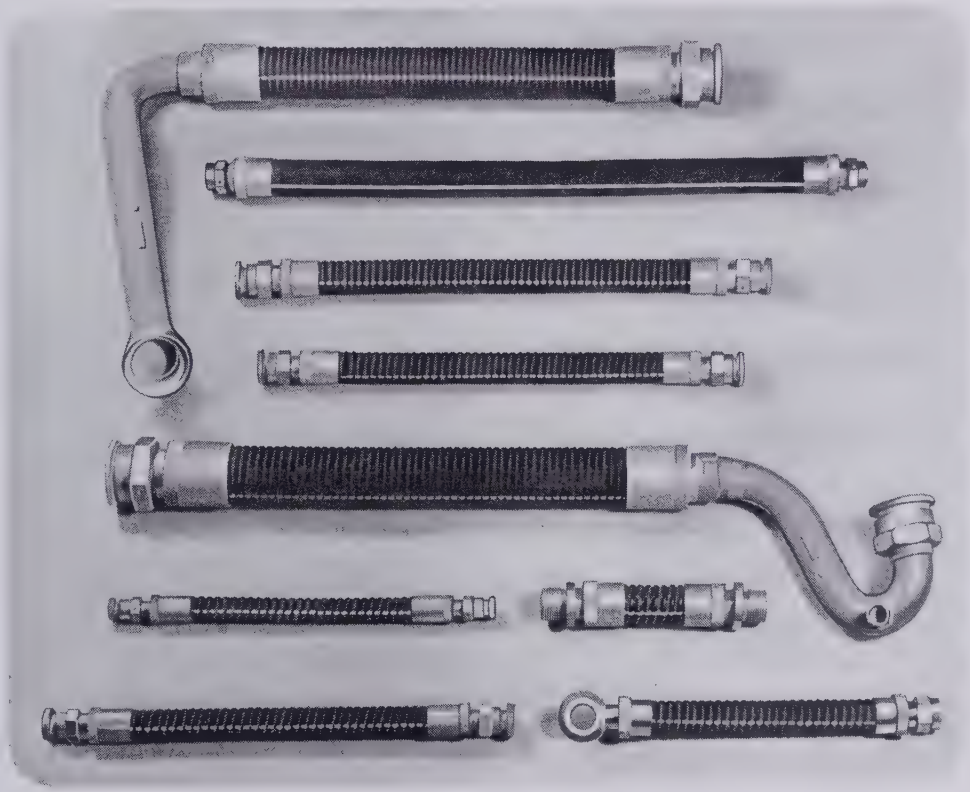


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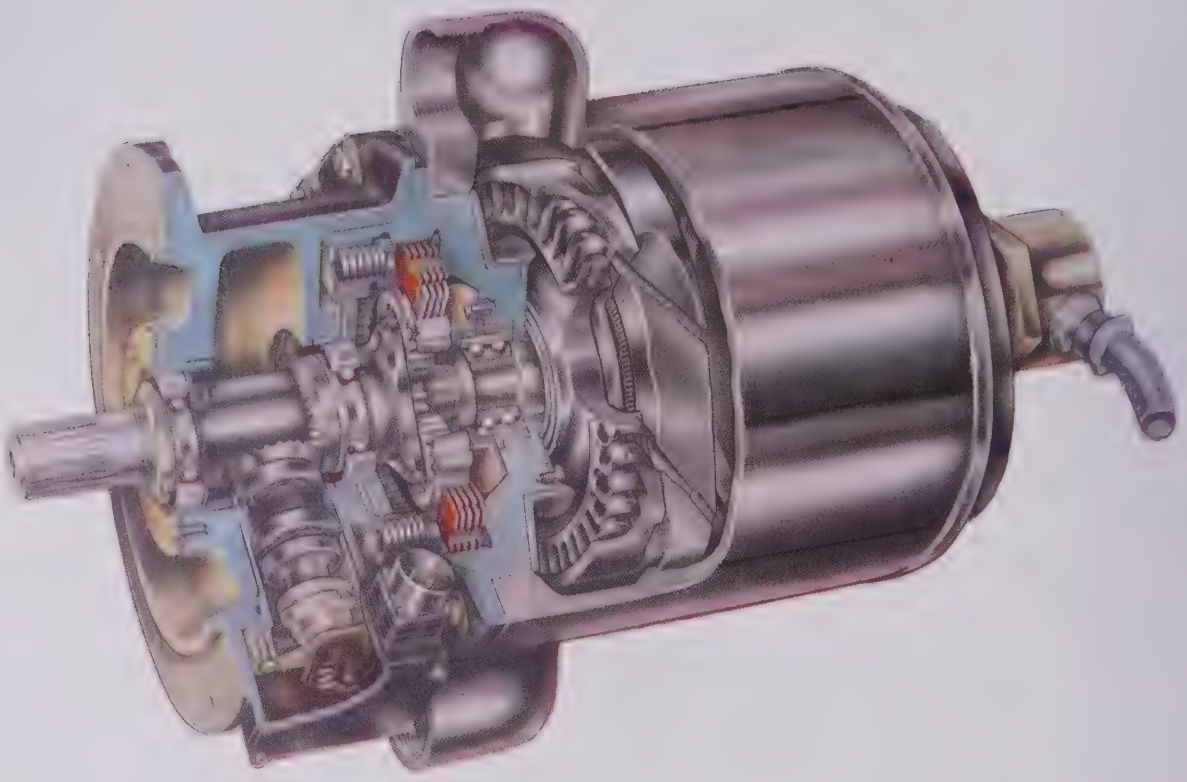
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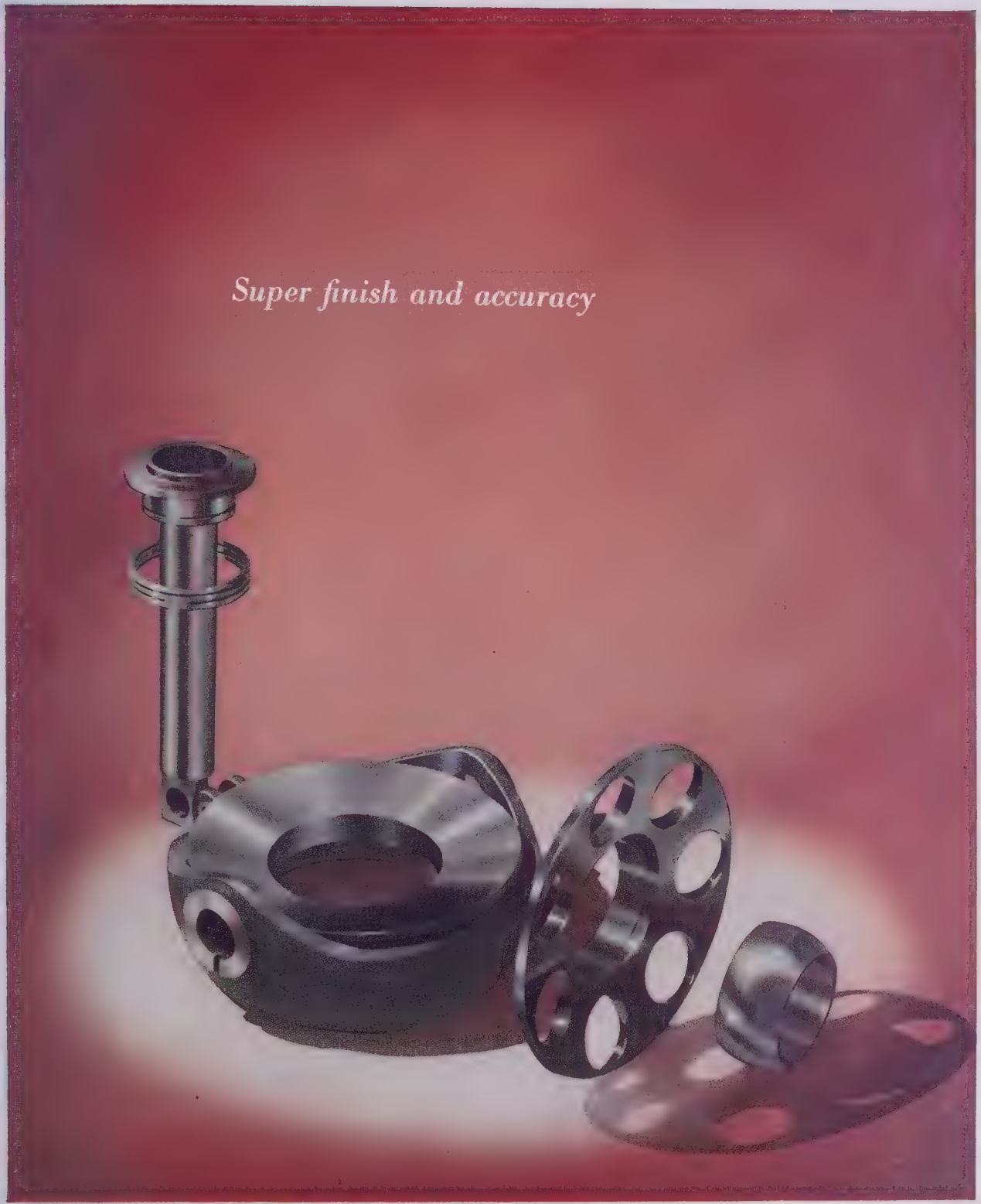
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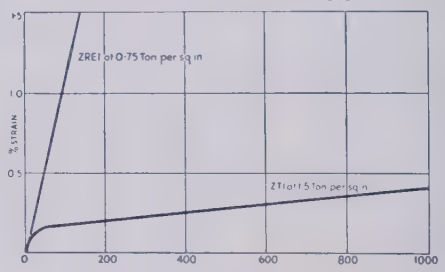
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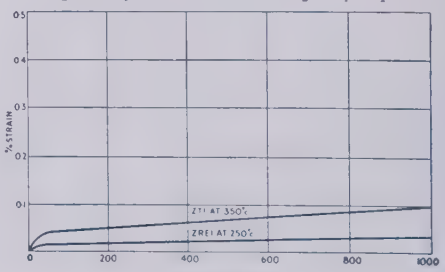
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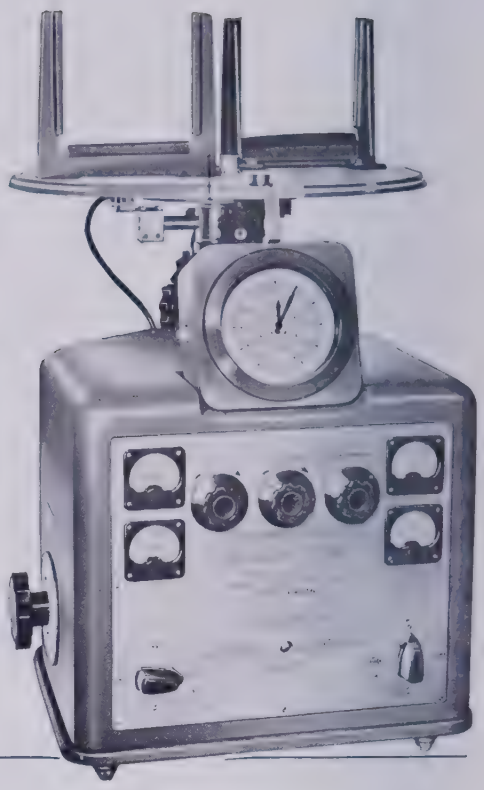
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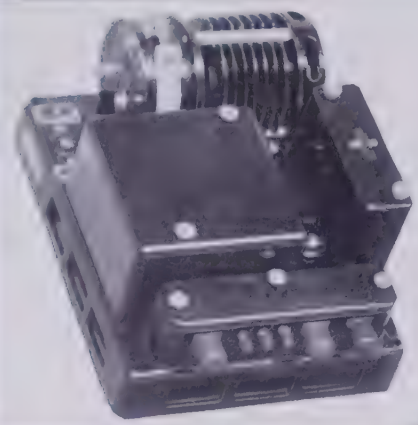
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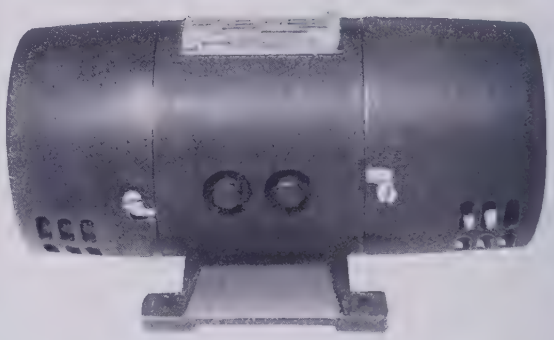
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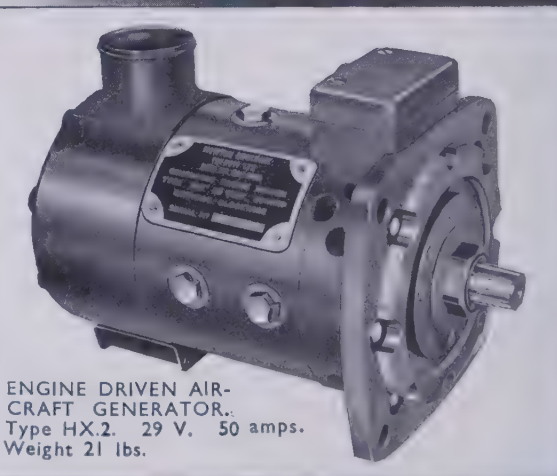
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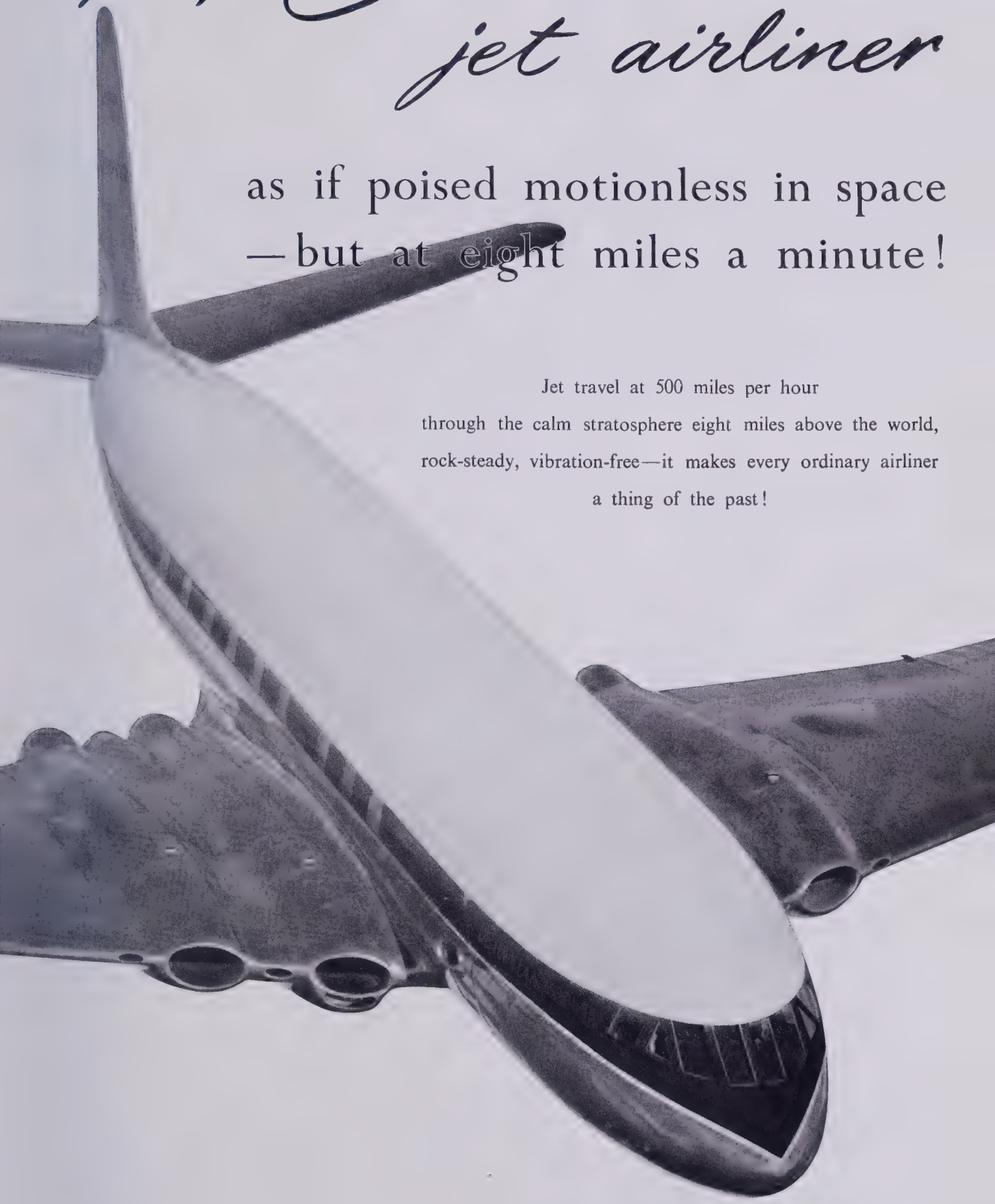
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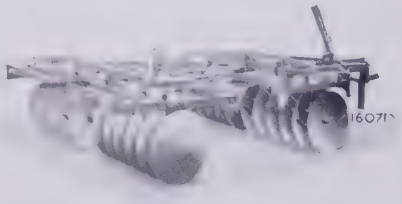
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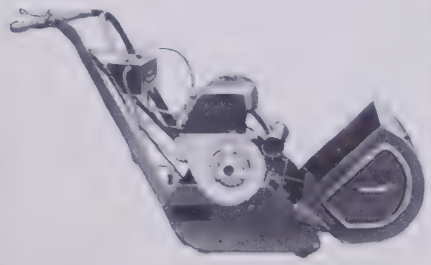
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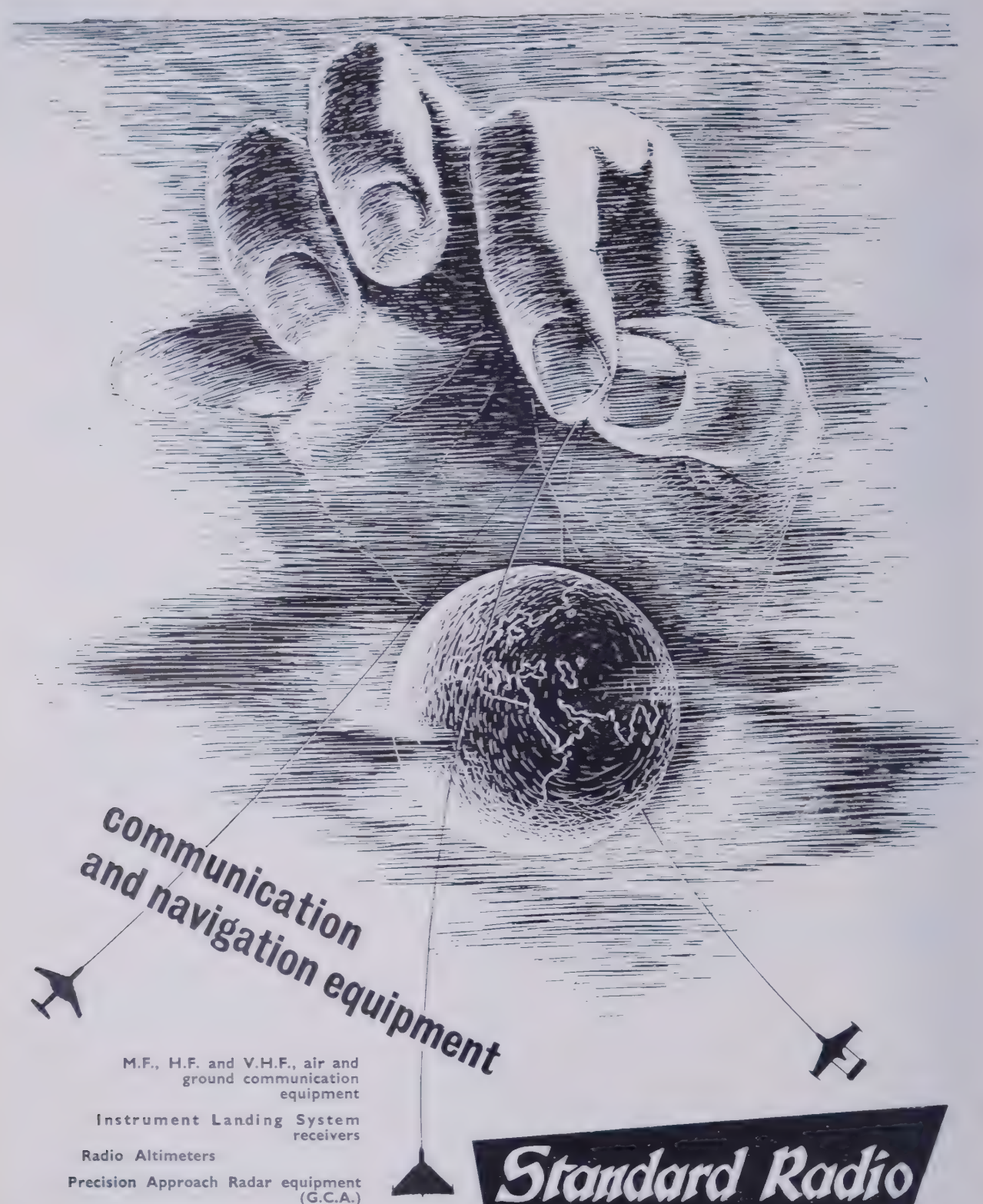
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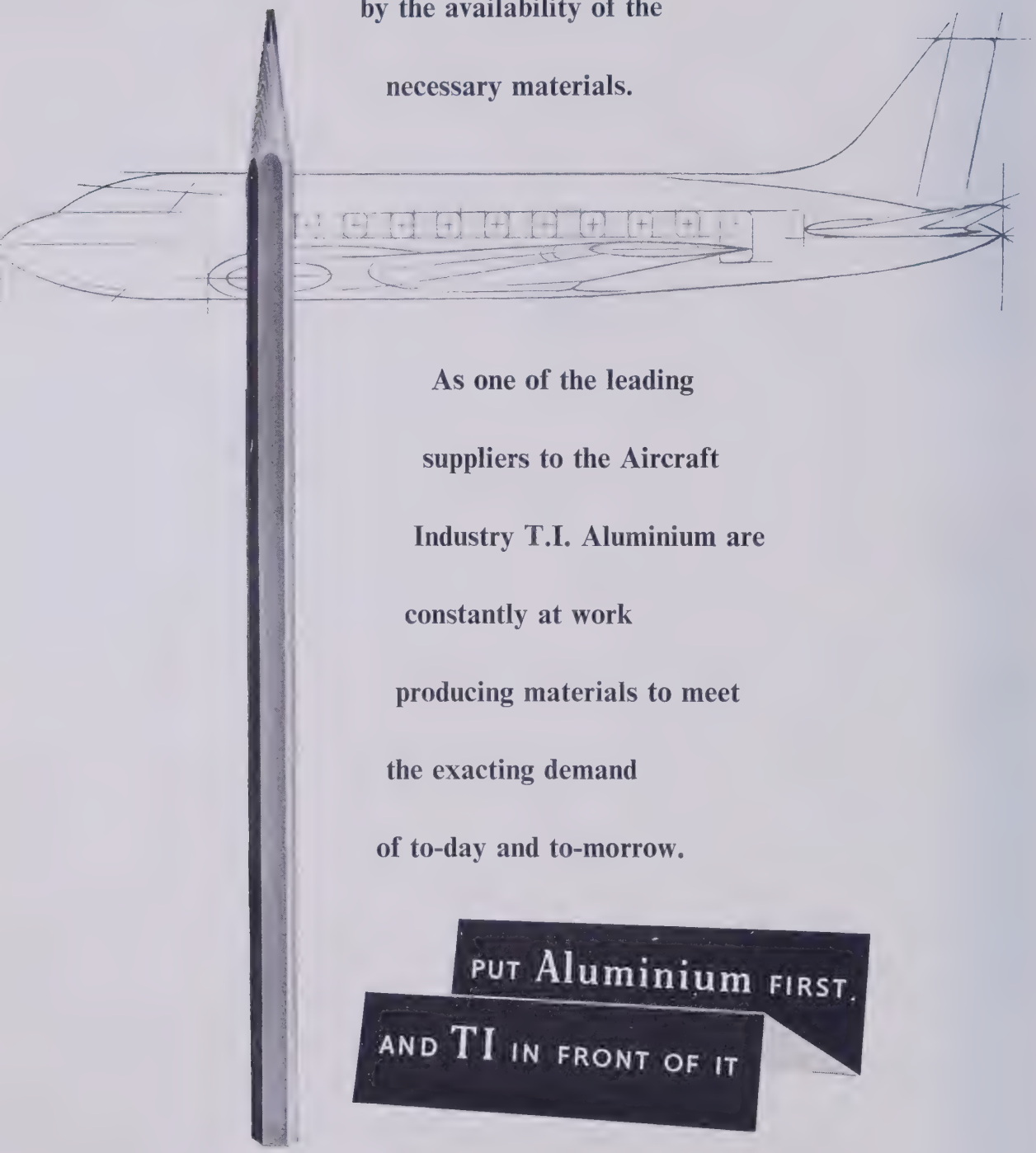
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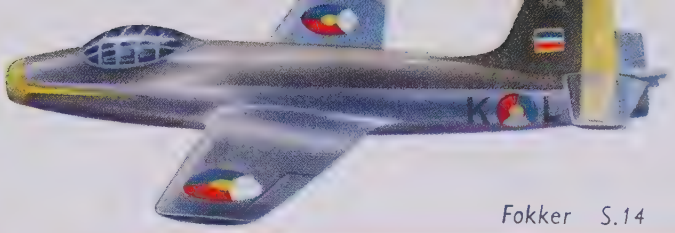


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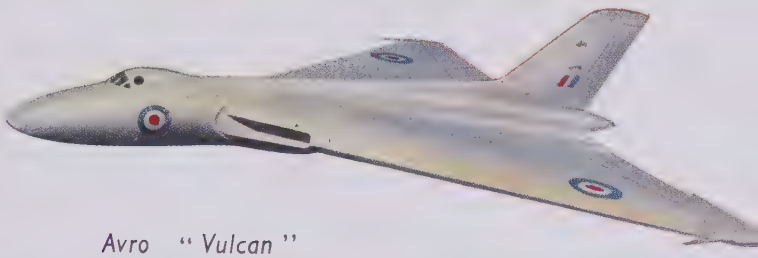
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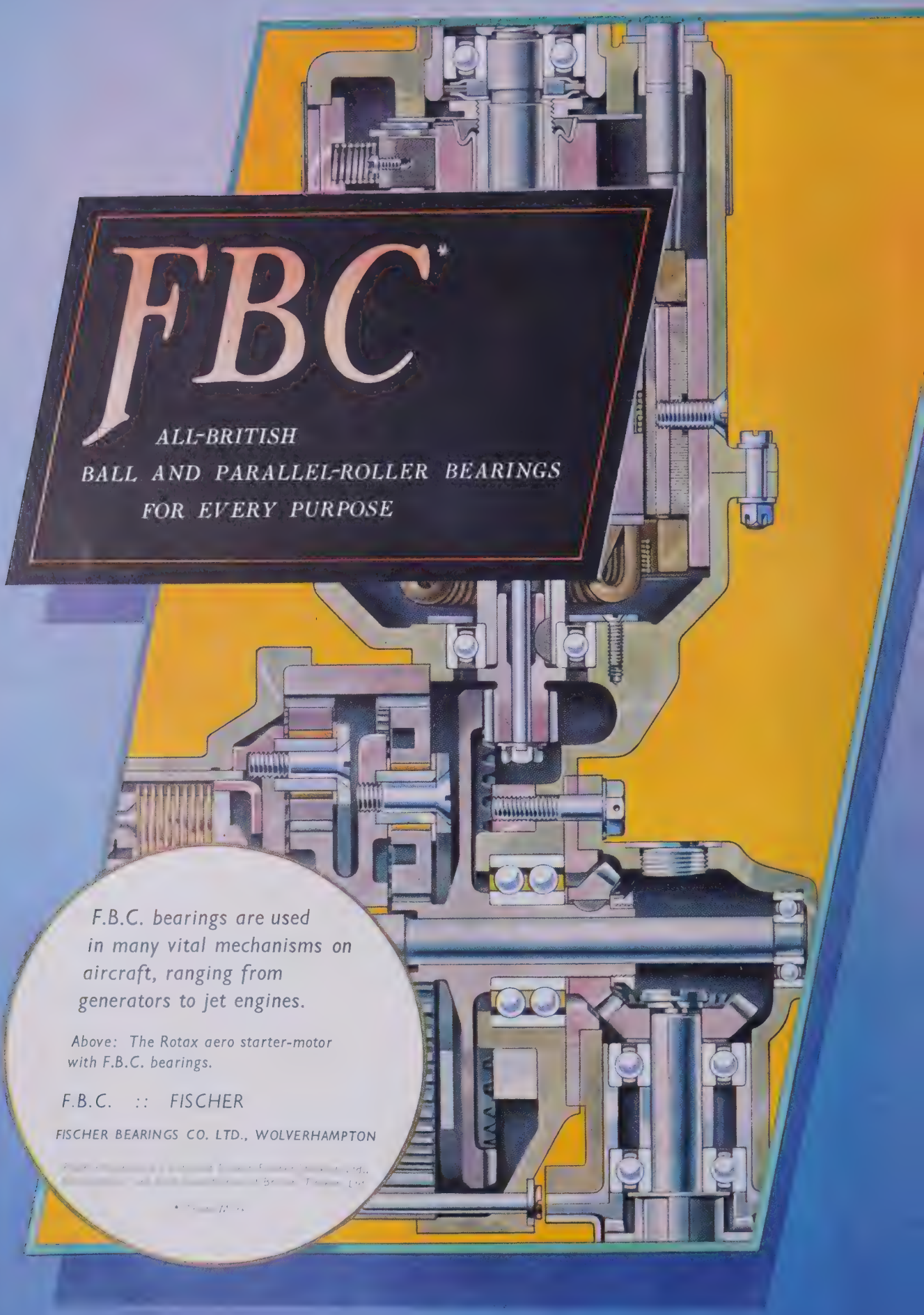
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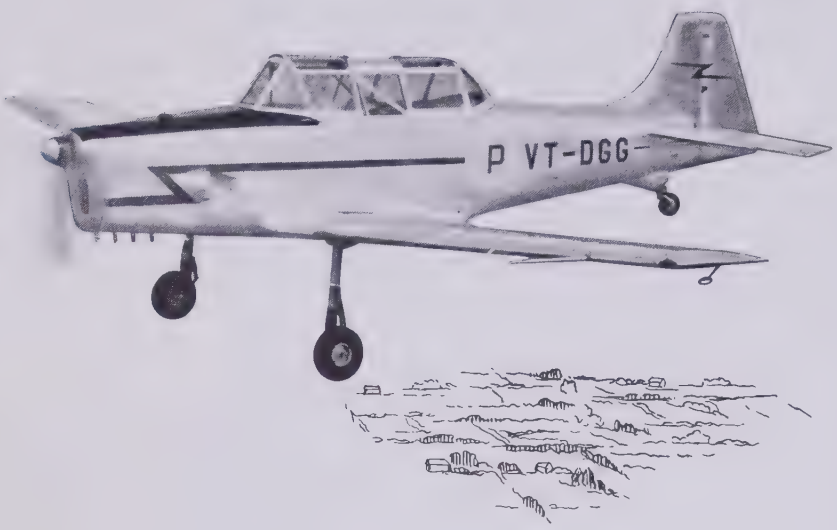
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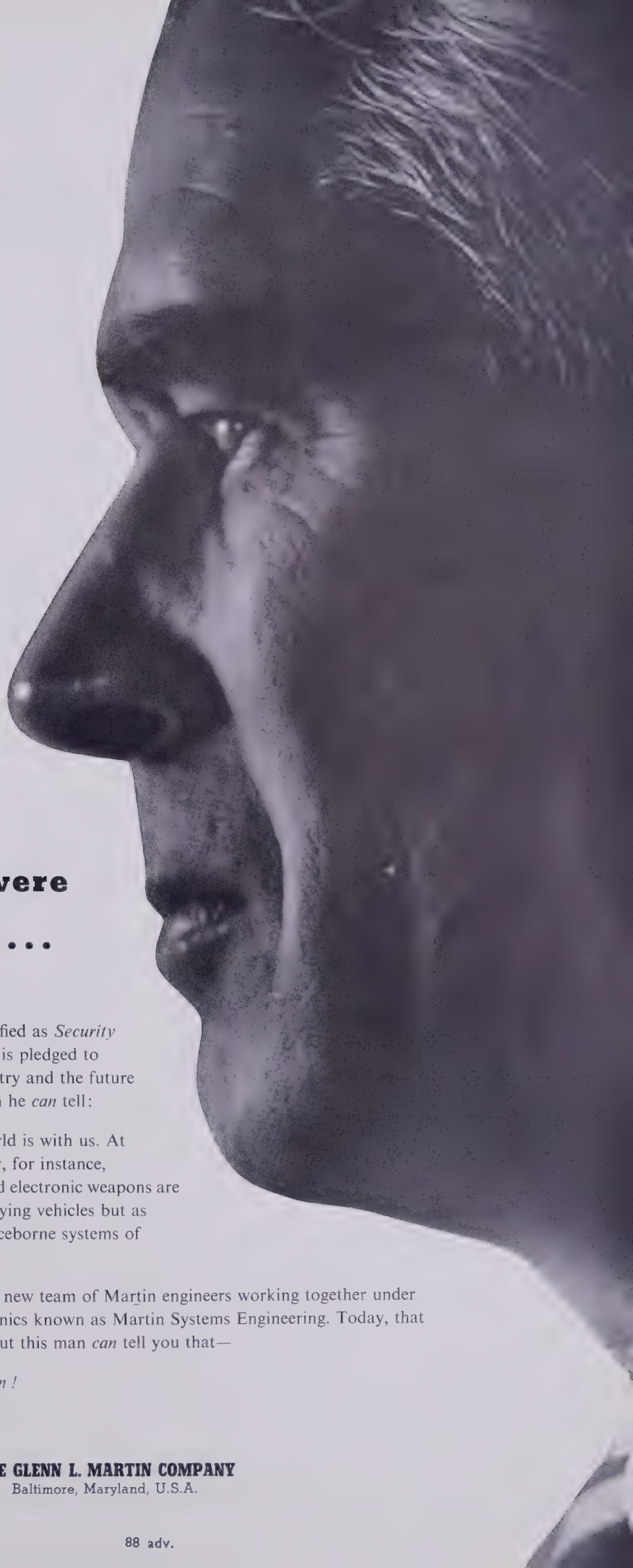


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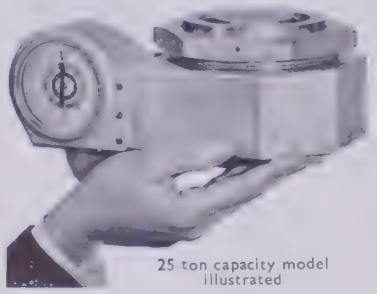
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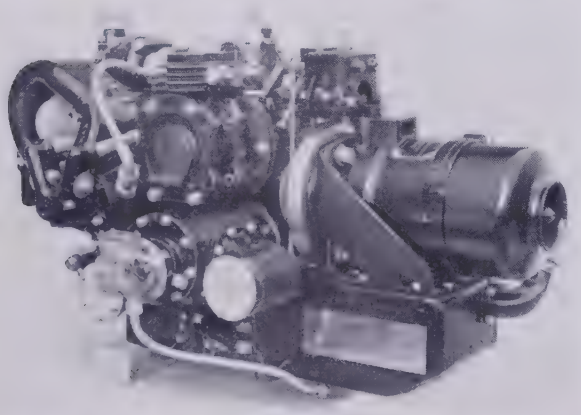
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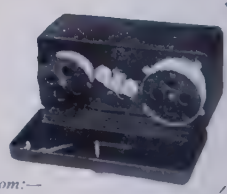
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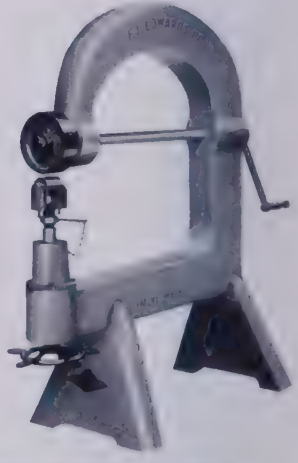
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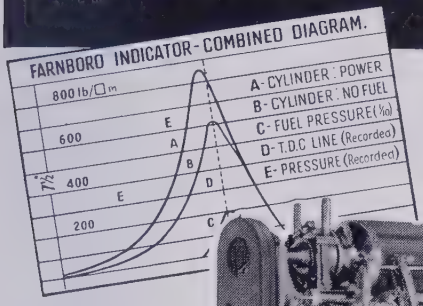
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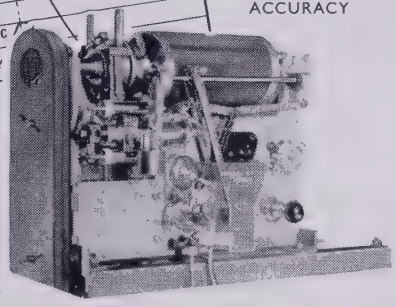
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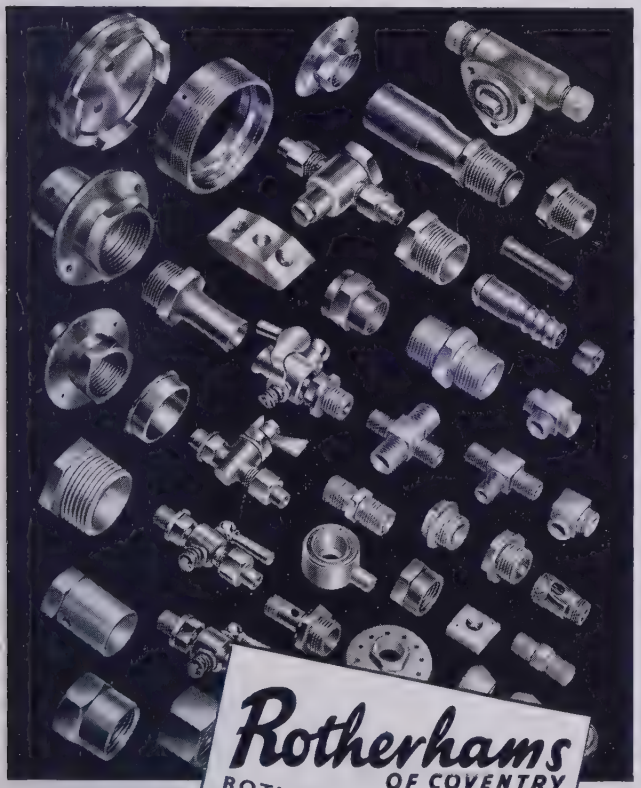


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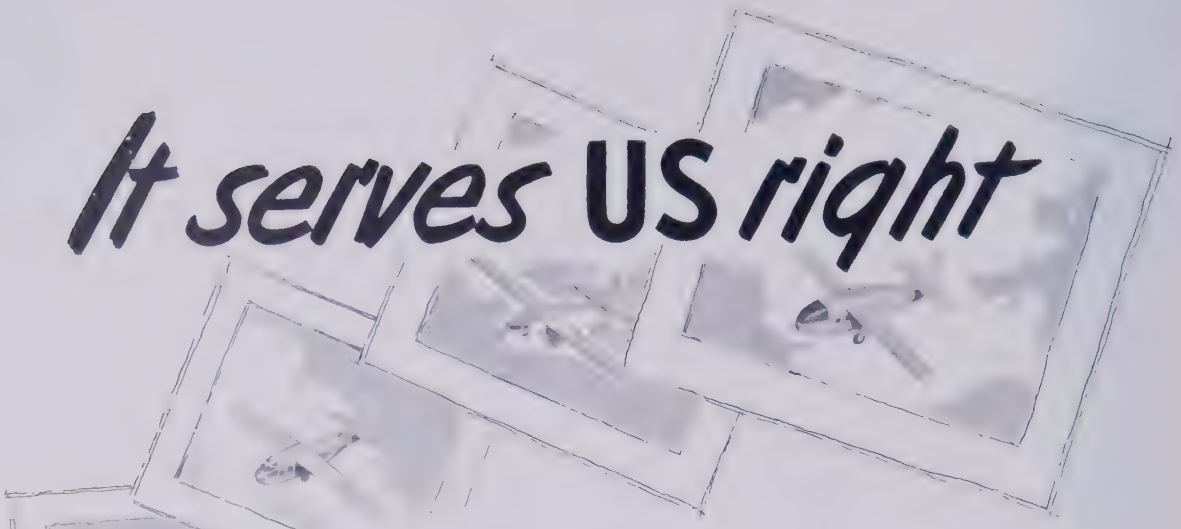
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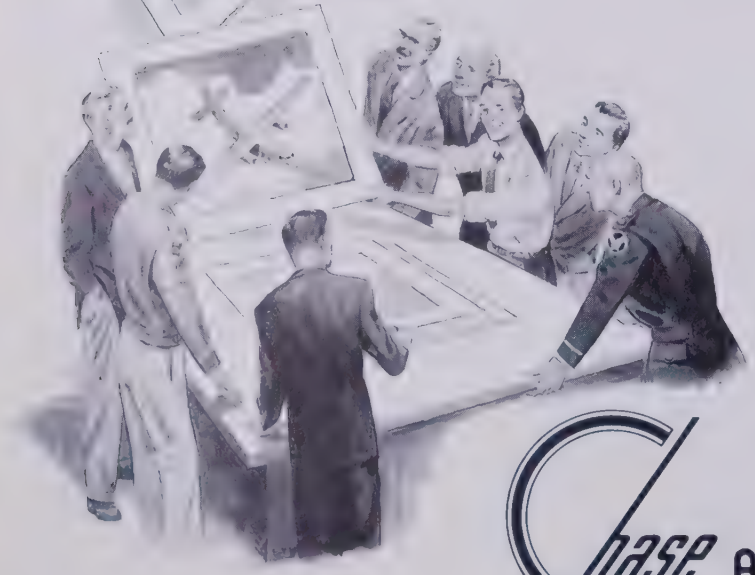


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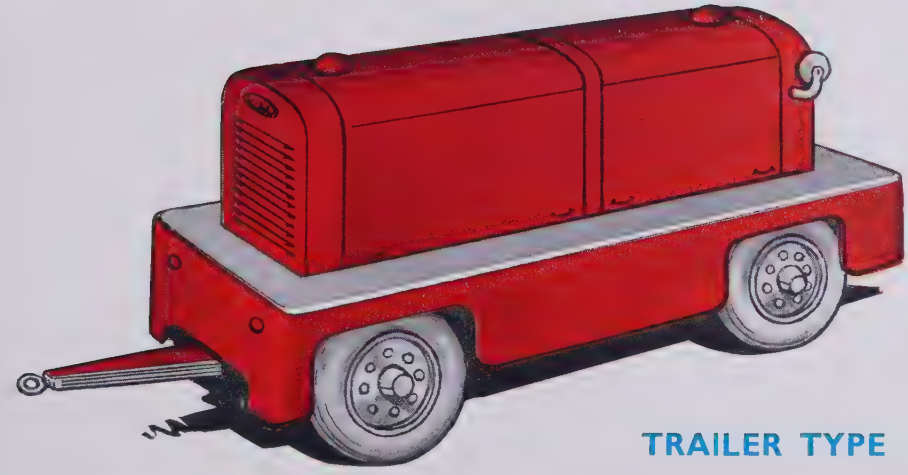
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PREFACE

THE publication of the 1953-54 edition of "All the World's Aircraft" coincides with the celebration of the fiftieth anniversary of the first flight of a powered aeroplane. Orville Wright's 12-second flight, the first of four made by the Wright Brothers on December 17, 1903, was the first in which an aeroplane carrying a man had raised itself by its own power; had gone forward in level flight without reduction of speed; and had finally landed at a point as high as that from which it had started.

In paying tribute to the memory of the Wright Brothers, we may perhaps be excused for drawing attention to the fact that Jane's "All the World's Aircraft" has been recording the progress of aviation through all but the first six years of this first half century of powered flight.

The first edition of Jane's appeared under the title "All the World's Air-Ships" (Aeroplanes and Dirigibles) in 1909 as a "standard work of reference giving uniform statistics" to record the large and increasing number of heavier- and lighter-than-air craft then in existence or being built. That first edition contained 374 pages. The present title "All the World's Aircraft" was introduced with the third (1912) edition.

In the year of publication of the first edition of Jane's, Louis Blériot had flown the English Channel from France to England to become the first man to link by air two countries separated by sea. At the time of Blériot's Channel crossing the greatest distance which had been flown over land was less than 100 miles, the greatest height reached was 450 feet and the longest time anyone had stayed in the air was 2 hours.

In 1952 the world's scheduled airlines carried 45 million passengers, seven million of them across the Atlantic; transported 925 million metric tons of cargo and flew 1,043 million miles on scheduled operations, a measure of the astonishing progress made in air transport in the lifetime of Jane's.

But "All the World's Aircraft," as its title implies, has been, and still is, primarily concerned with the progress made in aircraft and their power-plants, and it has, in fact, illustrated and described virtually every type of aircraft, which term includes aeroplanes, seaplanes, flying-boats and airships, from the Wright Brothers' early biplanes to the products of the present supersonic age. The complete set of volumes of "All the World's Aircraft" together form a unique record of the world's aeronautical development.

This 1953-54 edition, which has undergone the usual drastic revision, involving the resetting of all type-matter and the introduction of over 400 new illustrations, presents the most complete picture of the world's current aeronautical development. The section dealing with aircraft design contains descriptions and specifications of aircraft produced in twenty-nine countries and includes 620 illustrations, 370 of which are new. The United Kingdom and the United States of America, with 61 and 81 pages respectively, dominate this section, while France comes third with 30 pages. The reappearance of Japan as an aircraft-producing country has its significance.

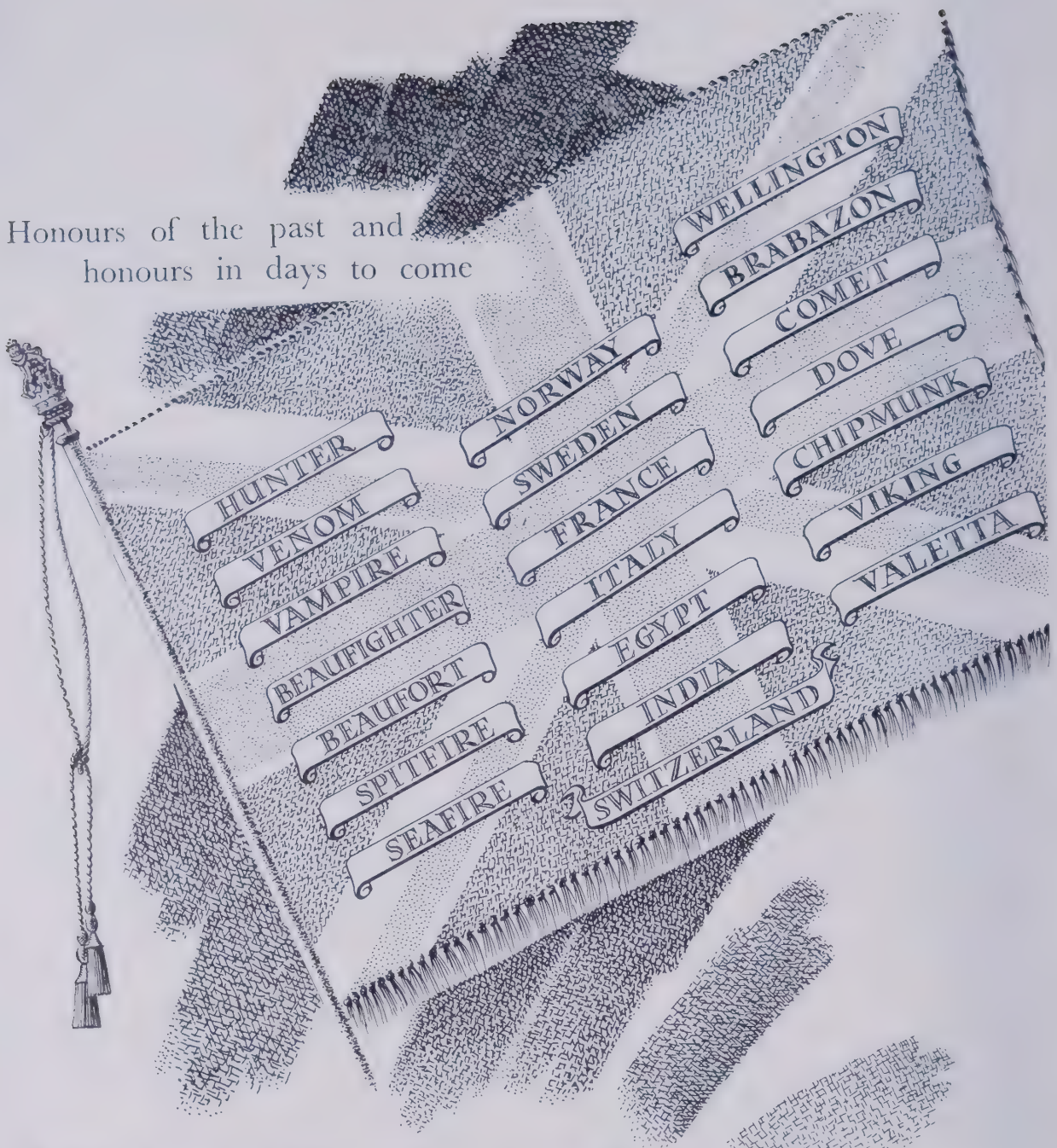
Once again, it is necessary to adopt a keynote of caution regarding information concerning Russian aircraft. The greatest care is taken each year to include any fresh information which has an air of authenticity, and this year Mr. Dennis Voaden has again given his most valuable help in revising the Russian section in the light of current knowledge. Defecting Polish and North Korean pilots have brought MIG-15 fighters over the iron curtain to provide the Western powers with much-sought information on this notable aeroplane and its power-plant but little other authentic news has become available concerning later developments. It is significant that the 1953 Soviet Aviation Day Display passed off quietly without any propagandist announcements of new and revolutionary designs being demonstrated for the first time, which has been the practice in earlier years.

The Engine Section contains 65 pages, 31 of them devoted to gas turbine engines and 34 to piston engines. In all there are 99 illustrations showing current models of aircraft power-plants of all types; including rocket motors, ramjets and pulsejet units.

The Airship section contains little that is new. The United States Navy still maintains an active airship branch and brief details are given of the new N and K type ships now being built by the Goodyear company for the U.S. Navy. Considerable modernisation of many of the wartime-built K-type ships is being undertaken, but security does not permit the publication of details of this work.

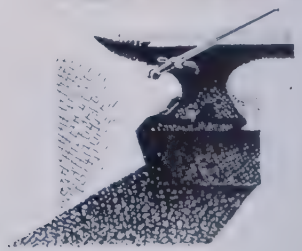
The section devoted to the Airlines of the World, first introduced in its present form in the last edition, has been considerably expanded and now contains a wealth of data such as is unobtainable anywhere else.

It would be ungenerous not to acknowledge the valuable help which has been received from many different sources throughout the world, without which the work involved in compiling and editing this volume would have been considerably more difficult. To the technical and publicity officials of the world's aircraft and aero-engine manufacturers and of the world's airline operators thanks are due for the careful attention given to our original questionnaires and to the many subsequent queries which arose during the course of compilation. With their co-operation it has been possible to ensure that, at the time of writing, the pages of "All the World's Aircraft" contained details of every



FOLLANDS of HAMBLE

are forging the weapons of the future



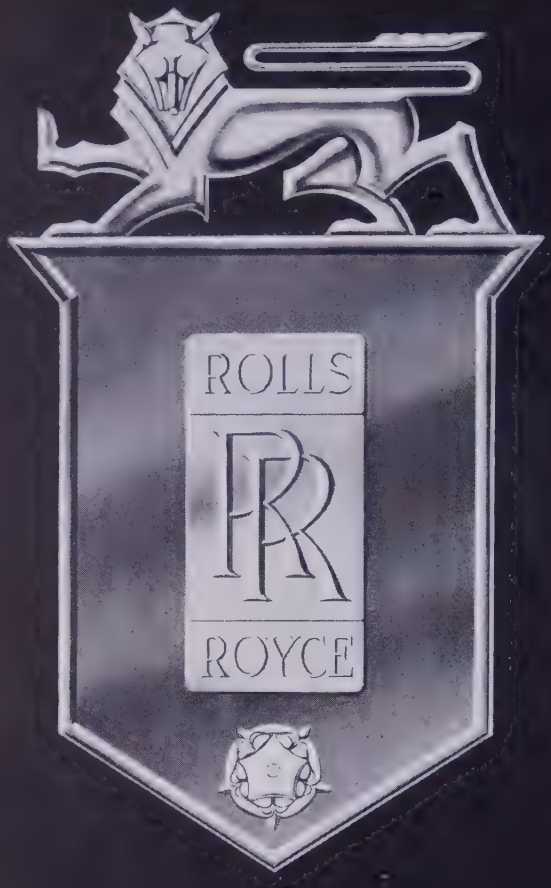
FOLLAND AIRCRAFT LIMITED, HAMBLE, SOUTHAMPTON, ENGLAND

aircraft and power-plant not enveloped in the smoke-screen of security. The Addenda pages contain photographs and brief details of five aircraft which appeared too late to be included in their appropriate places in the main body of the book.

Individual thanks are due to Mr. Dennis J. Voaden for his assistance with the Russian material, and to M. Guy Michelet, editor of the well-known and well-documented French publication *Aviation Magazine* for his readiness to lend a number of photographs of French aircraft. Mention should also be made of the very efficient information service of the Union Syndicale des Industries Aéronautiques which, through the agency of M. Robert Roux, made available much useful information which could not be obtained elsewhere. Thanks are also due to Messrs. Warren Bodie, Howard Levy, Harold Martin and Gordon Williams for making available to me photographic material of the highest class for inclusion in the American pages.

Finally, I would like to thank Mr. L. E. Bradford for his valuable services as a draughtsman. Every one of the many three-view drawings in this edition are as accurate and as up-to-date as possible. Apart from the many new drawings added this year, all others have been carefully checked and in many cases have been modified and/or redrawn. It is therefore with every confidence that I offer this 1953-54 edition of "All the World's Aircraft" as the most complete and up-to-date record of aeronautical progress in this fiftieth anniversary year of powered flight.

L.B.



ROLLS-ROYCE

AERO ENGINES

FOR SPEED AND RELIABILITY

ADDENDA

TO

JANE'S

ALL THE WORLD'S AIRCRAFT

1953-54

This Supplement contains photographs and information of aircraft which have become available for publication since the main book closed for press. In those cases where the photographs supplement descriptions and specifications in the main book, page references are given in the descriptive titles under the illustrations.

September 30th, 1953

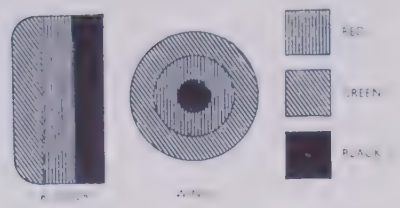
Printed and Bound in England by
NETHERWOOD DALTON & Co. Ltd.
HUDDERSFIELD

THE NATIONAL MARKINGS OF THE AIR FORCES OF THE WORLD

ARRANGED IN

ALPHABETICAL ORDER OF NATIONS

AFGHANISTAN



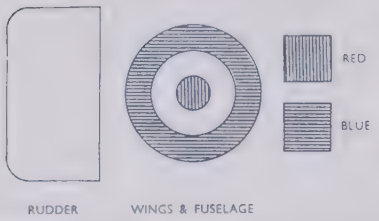
THE ROYAL AFGHAN AIR FORCE

ARGENTINE REPUBLIC



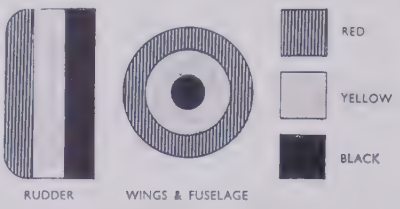
THE ARGENTINE AIR FORCE AND NAVAL AVIATION

AUSTRALIA



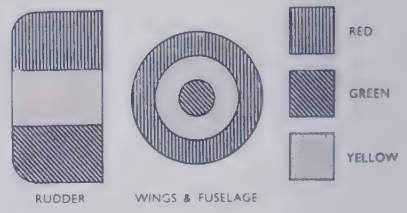
THE ROYAL AUSTRALIAN AIR FORCE

BELGIUM



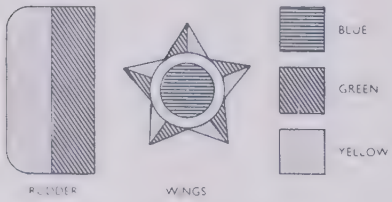
THE ROYAL BELGIAN AIR FORCE

BOLIVIA



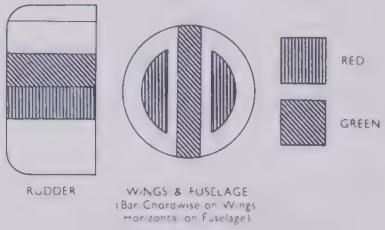
THE BOLIVIAN AIR FORCE

BRAZIL



THE BRAZILIAN AIR FORCE

BULGARIA



THE BULGARIAN AIR FORCE

BURMA



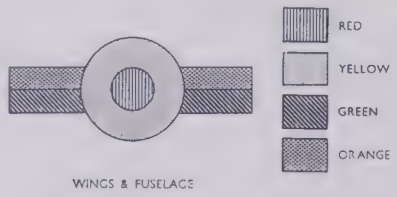
THE BURMESE AIR FORCE

CANADA



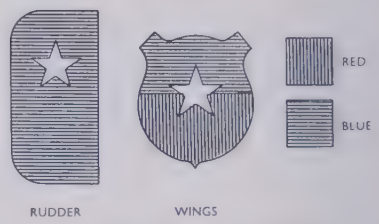
THE ROYAL CANADIAN AIR FORCE
AND NAVAL AVIATION

CEYLON



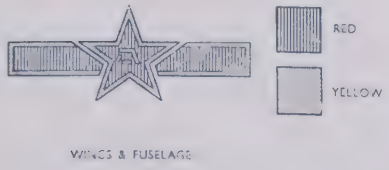
THE ROYAL CEYLON AIR FORCE

CHILE



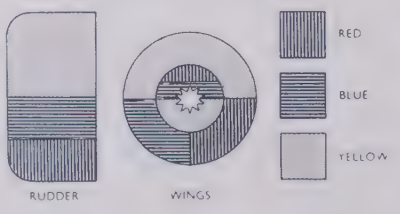
THE CHILEAN AIR FORCE

CHINA
(THE PEOPLE'S REPUBLIC)



THE CHINESE AIR FORCE

COLOMBIA



THE COLOMBIAN AIR FORCE

CUBA



THE CUBAN AIR CORPS

CZECHOSLOVAKIA



THE CZECHOSLOVAK AIR FORCE

DENMARK



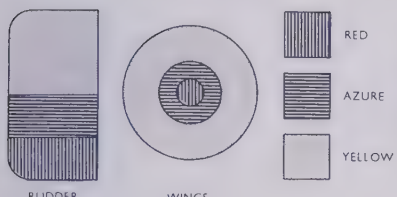
THE ROYAL DANISH AIR FORCE

DOMINICAN REPUBLIC



THE DOMINICAN AIR FORCE

ECUADOR



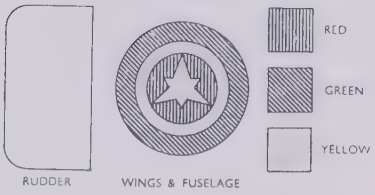
THE ECUADOREAN AIR FORCE

EGYPT



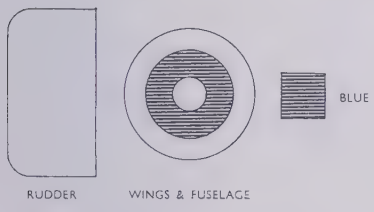
THE EGYPTIAN AIR FORCE

ETHIOPIA



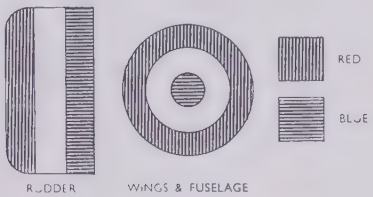
THE IMPERIAL ETHIOPIAN AIR FORCE

FINLAND



THE FINNISH AIR FORCE

FRANCE



(Naval Aircraft have Black Anchor superimposed)

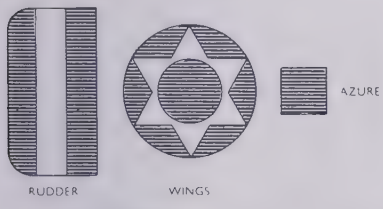
THE FRENCH AIR FORCE AND NAVAL AVIATION

GREAT BRITAIN



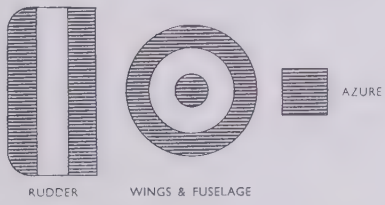
THE ROYAL AIR FORCE AND FLEET AIR ARM

GUATEMALA



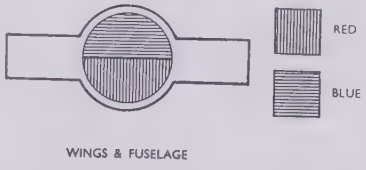
THE GUATEMALAN AIR FORCE

GREECE



THE ROYAL HELLENIC AIR FORCE

HAITI



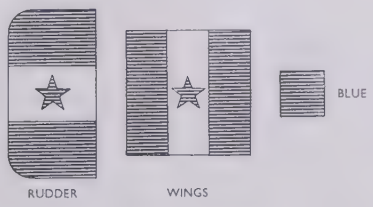
CORPS D'AVIATION D'HAITI

HUNGARY



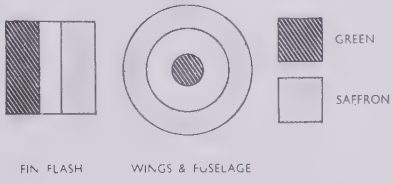
THE HUNGARIAN AIR FORCE

HONDURAS



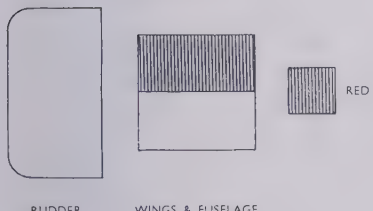
THE HONDURAS MILITARY AIR ARM

INDIA



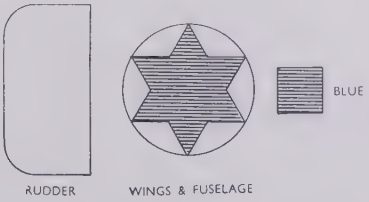
THE INDIAN AIR FORCE

INDONESIA



THE INDONESIAN AIR FORCE

ISRAEL



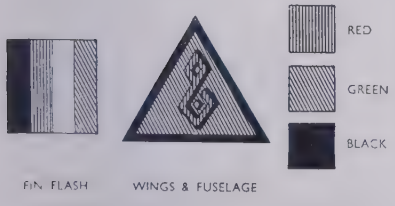
THE ISRAEL AIR FORCE

IRAN



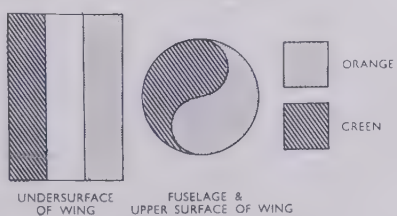
THE IMPERIAL IRANIAN AIR FORCE

IRAQ



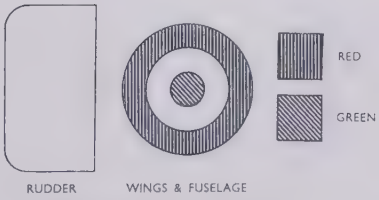
THE ROYAL IRAQI AIR FORCE

IRELAND



THE IRISH AIR CORPS

ITALY



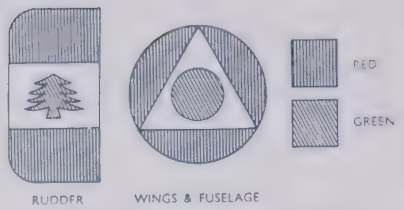
THE ITALIAN AIR FORCE

JORDAN



THE ARAB LEGION AIR FORCE

LEBANON



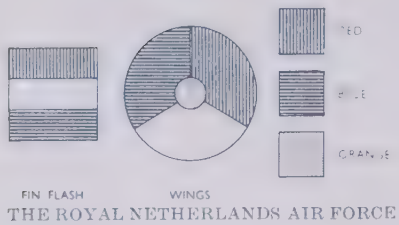
THE LEBANESE AIR FORCE

MEXICO



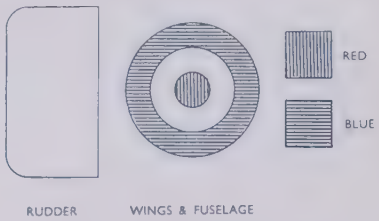
THE MEXICAN AIR FORCE

NETHERLANDS



THE ROYAL NETHERLANDS AIR FORCE

NEW ZEALAND



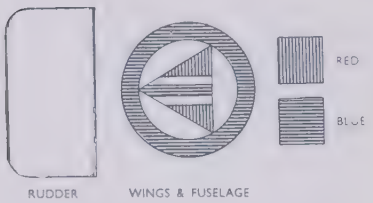
THE ROYAL NEW ZEALAND AIR FORCE

NICARAGUA



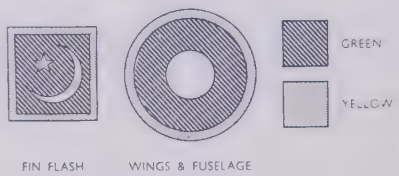
THE NICARAGUAN ARMY AIR FORCE

NORWAY



THE ROYAL NORWEGIAN AIR FORCE

PAKISTAN



THE ROYAL PAKISTAN AIR FORCE

PERU



THE PERUVIAN AIR FORCE

PARAGUAY



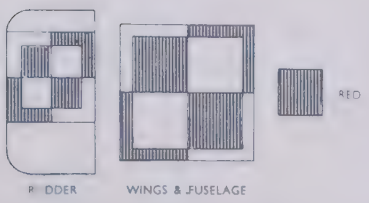
THE PARAGUAYAN AIR FORCE

PHILIPPINE REPUBLIC



THE PHILIPPINE AIR FORCE

POLAND



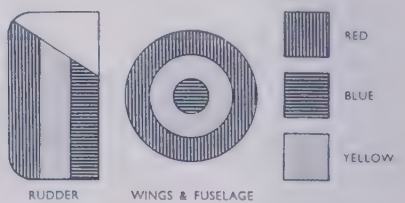
THE POLISH AIR FORCE

PORTUGAL



THE PORTUGUESE AIR ARM

RUMANIA



THE RUMANIAN AIR FORCE

SALVADOR



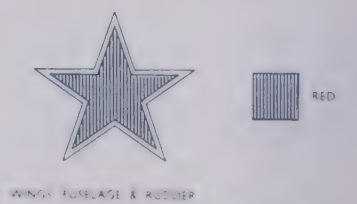
THE MILITARY AIR ARM

SOUTH AFRICA



THE SOUTH AFRICAN AIR FORCE

SOVIET UNION



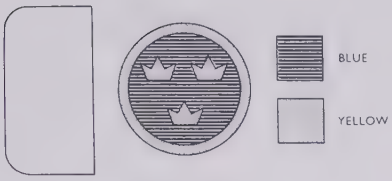
THE RUSSIAN AIR FORCE

SPAIN



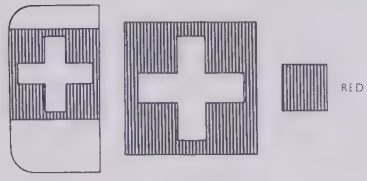
THE SPANISH AIR FORCE

SWEDEN



THE ROYAL SWEDISH AIR FORCE

SWITZERLAND



THE SWISS AIR FORCE

SYRIA



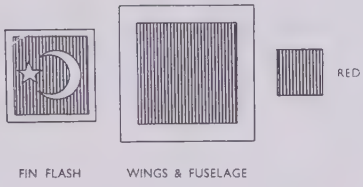
THE SYRIAN AIR FORCE

THAILAND



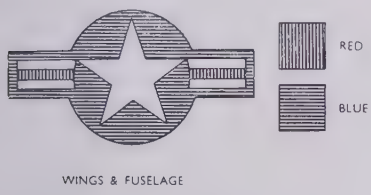
THE ROYAL THAI AIR FORCE

TURKEY



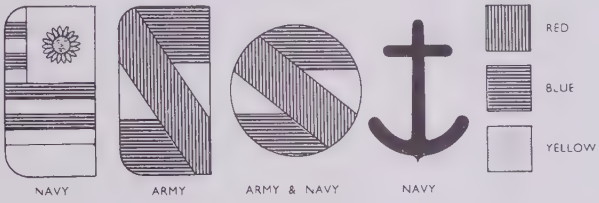
THE TURKISH AIR FORCE

UNITED STATES OF AMERICA



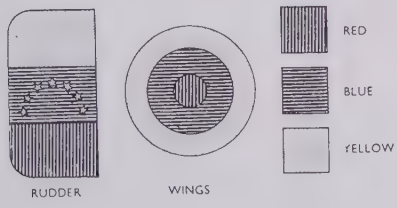
THE UNITED STATES AIR FORCE AND NAVAL AVIATION

URUGUAY



URUGUAYAN MILITARY AND NAVAL AVIATION

VENEZUELA



THE VENEZUELAN AIR FORCES

YUGOSLAVIA



THE YUGOSLAV AIR FORCE

THE WORLD'S CIVIL AVIATION

ARRANGED IN

ALPHABETICAL ORDER OF NATIONS

INCLUDING DETAILS OF THE INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO), THE INTERNATIONAL AIR TRANSPORT ORGANIZATION (IATA), THE FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (FAI), AND OF THE AIRLINES OF THE WORLD

INTERNATIONAL CIVIL AIRCRAFT MARKINGS

AN- Nicaragua.
AP- Pakistan.
B- Nationalist China.
CB- Bolivia.
CC- Chile.
CCCP- Soviet Union (U.S.S.R.)
CF- Canada.
CN- Morocco.
CR- Portuguese Colonies.
CS- Portugal.
CU- Cuba.
CX- Uruguay.
CY- Ceylon.
CZ- Principality of Monaco.
EC- Spain.
EI- and **EJ-** Ireland.
EL- Liberia.
EP- Iran.
ET- Ethiopia.
F- France, Colonies and Protectorates, less Morocco.
G- United Kingdom.
HA- Hungary.
HB- Switzerland.
HC- Ecuador.
HH- Haiti.
HI- Dominican Republic.
HK- Colombia.
HS- Thailand.
HZ- Saudi Arabia
I- Italy.
JA- Japan.
LN- Norway.
LV- Argentine Republic.
LX- Luxembourg.
LZ- Bulgaria.
MC- Monte Carlo.
N United States of America.
OB- Peru.
OD- Lebanon.
OE- Austria.
OH- Finland.
OK- Czechoslovakia.
OO- Belgium.
OY- Denmark.
PH- Netherlands.
PI- Philippine Republic.
PJ- Curaçao (Netherlands West Indies).
PK- Indonesia.
PP- and **PT-** Brazil.
PZ- Suriname (Netherlands Guiana).
RX- Republic of Panama.
SE- Sweden.
SN- Sudan.
SP- Poland.
SU- Egypt.
SX- Greece.
TC- Turkey.
TF- Iceland.
TG- Guatemala.
TI- Costa Rica.
TJ- Jordan.
VH- Australia.

VP-, **VQ-**, **VR-** British Colonies and Protectorates as follow :—

VP-AAA—VP-AZZ Gold Coast with Ashanti, Northern Territories of Gold Coast in British Togoland.
VP-BAA—VP-BZZ Bahamas.
VP-FAA—VP-FZZ Falkland Islands.
VP-GAA—VP-GZZ British Guiana.
VP-HAA—VP-HZZ British Honduras.
VP-JAA—VP-JZZ Jamaica.
VP-KAA—VP-KZZ Colonies and the Protectorate of Kenya.
VP-LAA—VP-LZZ Leeward Islands.
VP-MAA—VP-MZZ Malta.
VP-NAA—VP-NZZ Protectorate of Nyasaland.
VP-PAA—VP-PZZ Islands under the rule of the Western Pacific High Commission.
VP-RAA—VP-RZZ Northern Rhodesia.
VP-SAA—VP-SZZ Protectorate of Somaliland.
VP-TAA—VP-TZZ Trinidad and Tobago.
VP-UAA—VP-UZZ Protectorate of Uganda.
VP-VAA—VP-VZZ St. Vincent.
VP-XAA—VP-XZZ Colonies and Protectorate of Gambia
VP-YAA—VP-YZZ Southern Rhodesia.
VP-ZAA—VP-ZZZ Protectorate of Zanzibar.
VQ-BAA—VQ-BZZ Barbados.
VQ-CAA—VQ-CZZ Cyprus.
VQ-FAA—VQ-FZZ Fiji Islands.
VQ-GAA—VQ-GZZ Grenada.
VQ-HAA—VQ-HZZ St. Helena.
VQ-LAA—VQ-LZZ St. Lucia.
VQ-MAA—VQ-MZZ Mauritius.
VQ-SAA—VQ-SZZ Seychelle Islands.
VR-BAA—VR-BZZ Bermuda.
VR-GAA—VR-GZZ Gibraltar.
VR-HAA—VR-HZZ Hong Kong.
VR-JAA—VR-JZZ Johore.
VR-LAA—VR-LZZ Colonies and Protectorate of Sierra Leone.
VR-NAA—VR-NZZ Colonies and Protectorate of Nigeria including British Cameroons.
VR-RAA—VR-RZZ Federation of Malaya and Singapore.
VR-TAA—VR-TZZ Tanganyika.
VR-UAA—VR-UZZ State of Brunei (British North Borneo).

VT- India.
XA-, **XB-** and **XC-** Mexico.
XH- Honduras.
XY- and **XZ-** Burma.
YA- Afghanistan.
YE- Yemen.
YI- Iraq.
YJ- New Hebrides Condominium.
YK- Syria.
YR- Rumania.
YS- El Salvador.
YU- Yugoslavia.
YV- Venezuela.
ZA- Albania.
ZK-, **ZL-** and **ZM-** New Zealand.
ZP- Paraguay.
ZS-, **ZT-** and **ZU-** Union of South Africa.
4X- Israel.

INTERNATIONAL ORGANIZATIONS

THE INTERNATIONAL CIVIL AVIATION ORGANIZATION (I.C.A.O.)

HEADQUARTERS: International Aviation Building, Montreal, Canada.

THE COUNCIL

President: Dr. Edward Warner (U.S.A.).

Member of the Council for the United Kingdom: Sir Frederick Tymms.

Secretary General: E. C. R. Ljungberg (Sweden).

Assistant Secretary General for Air Navigation: A. Ferrier (Canada).

Assistant Secretary General for Air Transport: E. M. Weld (U.S.A.).

Director, Bureau of Administration and Services: R. Gilbert (U.K.).

Director, Legal Bureau: P. K. Roy (India).

Director, Technical Assistance: E. R. Marlin (U.S.A.).

Chief, Public Information: L. C. Boussard (France).

Member States (as at July 1, 1953): Afghanistan, *Argentina, *Australia, Austria, *Belgium, Bolivia, *Brazil, Burma, *Canada, Ceylon, Chile, Colombia, Cuba, Czechoslovakia, Denmark, Dominican Republic, *Egypt, El Salvador, Ethiopia, Finland, *France, Greece, Guatemala, Haiti, Honduras, Iceland, *India, Indonesia, Iran, Iraq, *Ireland, Israel, *Italy, Jordan, Korea, *Lebanon, Liberia, Libya, Luxembourg, *Mexico, *Netherlands, New Zealand, Nicaragua, *Norway, Pakistan, Paraguay, Peru, *Philippine Republic, Poland, *Portugal, *Spain, Sweden, Switzerland, Syria, Thailand, Turkey, *Union of South Africa, *United Kingdom, *United States, *Venezuela.
(*denotes Member of Council).

The International Civil Aviation Organization, successor to the Provisional International Civil Aviation Organization (P.I.C.A.O.), came into being on April 4, 1947, following the ratification of the Permanent Convention by the required number of States.

The Organization consists of an Assembly and a Council.

The Assembly

Meets annually and is convened by the Council. Extraordinary meetings of the Assembly may be held at any time when called by the Council or at the request of any ten member States. All member States have equal right to be represented at the meetings of the Assembly and each member is entitled to one vote. The powers and duties of the Assembly are: (*a*) to elect at each meeting its president and officers; (*b*) to elect the member States to be represented on the Council; (*c*) to examine and take action upon the reports of the Council; (*d*) to determine its own rules of procedure and establish such subsidiary commissions and committees as are needed; approve an annual budget and determine the financial arrangements of the Organization; (*e*) to refer any specific matters to the Council; (*f*) to delegate the necessary powers and authority to the Council which are needed for the duties of the organization; and (*g*) to deal with any matters not specifically assigned to the Council.

The Council

The Council is composed of 21 member States elected by the Assembly for a period of three years, adequate representation being given to: (1) those member States of chief importance in air transport; (2) those member States not otherwise included which make the largest contribution to the provision of facilities for international civil air navigation; (3) those member States not otherwise included whose election will ensure that all major geographical areas of the World are represented. No representative of a member State on the Council may be actively associated with or financially interested with the operation of an international air service.

The Council elects a President, who has no vote. One or more vice-presidents are elected from among the members, and retain the right to vote when serving as acting president. Decisions of the Council are deemed valid when approved by a majority of all members. Any member State not a member of the Council may participate in deliberations whenever any decision is to be taken which especially concerns such a member State, but such a State may not vote. In any case in which there is a dispute between one or more member States not members of the Council and one or more member States who are members of the Council, any State within the second category which is party to the dispute shall have no right to vote on that dispute.

The duties and powers of the Council are:—

(1) to discharge the directives of the Assembly.

(2) to determine its own organization.

(3) to determine the method of appointment, emoluments and conditions of service of the employees of the organization.

(4) to appoint a Secretary-General.

(5) to provide for the establishment of any subsidiary working groups which may be considered desirable, including the following:—

(*a*) A Committee on Air Transport.
(*b*) A Commission on Air Navigation.

(6) to prepare and submit to the Assembly budget estimates of the Organization and statements of accounts of all reports and expenditures.

(7) to enter into agreements with other international bodies when deemed advisable for the maintenance of common service and for common arrangements concerning personnel and, with the approval of the Assembly, enter into such other arrangements as may facilitate the work of the Organization.

In addition, the functions of the Council are to maintain liaison with the member States, calling on them for such data and information as may be required; receive, register and hold open to inspection by member States, all existing contracts and agreements covering routes, services, landing rights, airport facilities, or other international air matters to which any member State or its airlines is a party; supervise and co-ordinate the works of the subsidiary bodies, consider their reports and transmit them and the findings of the Council to the member States. In addition, the Council is to make recommendations on technical matters to the member States of the Assembly, and submit an annual report to the Assembly. When requested by all the parties concerned, the Council will act as an arbitral body on any difference arising among member States relating to international civil aviation matters which may be submitted to it.

The expenses of the Organization are borne by the member States in proportions decided by the Assembly. Each member State bears the expenses of its own delegation to the Assembly and those of its delegates on the Council and its representatives on committees or subsidiary groups.

Each contracting State undertakes that its international airlines shall file traffic reports, cost statistics and financial states with the Council. Each contracting State may designate the route to be followed within its territory by any international air service, and the airports which any such service may use. If the Council is of the opinion that the airports or other navigation facilities of a contracting State are not reasonably adequate the Council may consult with the State and others affected, to find means of correcting the position and may make recommendations. If requested by the State, the Council may provide all or a portion of the costs needed for the remedies.

A contracting State may at any time discharge any obligation into which it has entered and take over airports and other facilities which the Council has established in its territory by paying to the Council an amount considered reasonable.

The Council may suggest to contracting States that they form joint organizations to operate air services on any routes or in any regions.

The duties of the subsidiary bodies established under the Council shall be:—

Air Transport. To observe, correlate and report continuously on facts concerning the origin and volume of international air traffic and the relation of such traffic, or the demand for it, to the facilities provided; collect, analyse and report on subsidies, tariffs and costs of operation; study matters affecting the organization and operation of international air services, including the international ownership and operation of international trunk lines; and study and report, with recommendations to the Assembly on matters on which agreement was not reached at the Chicago International Civil Aviation Conference.

Air Navigation. To study and advise the Council on standards and procedures for communications systems and air navigation aids including rules of the air, traffic control practices, licensing of operating and mechanical personnel, airworthiness, registration and identification of aircraft, meteorological protection of international aeronautics, log books, maps and charts, airports, customs, accident investigation and so forth. In addition it will work towards the adoption of minimum requirements and standard procedures for all the above and continue the preparation of technical documents in accordance with the recommendations of the Chicago Conference.

THE INTERNATIONAL AIR TRANSPORT ASSOCIATION (I.A.T.A.)

HEAD OFFICE: International Aviation Building, Montreal 3, P.Q., Canada.

BRANCH OFFICES: 30, Curzon Street, W.1, London (I.A.T.A. Clearing House, I.A.T.A. European Technical Liaison Office); 165, Broadway, New York 4 (I.A.T.A. Traffic Conference No. 1, I.A.T.A. Enforcement Office); 509, Madison Avenue, New York 22 (I.A.T.A. Tariffs Office); 76-78, Champs Elysees, Paris (VIIe) (I.A.T.A. Traffic Conference No. 2); MacDonald House, Singapore, F.M.S. (I.A.T.A. Traffic Conference No. 3).

President: Dr. Walter Berchtold (Swissair).

President-elect: Gordon R. McGregor (Trans-Canada Airlines).

Director General: Sir William P. Hildred.

Treasurer: Dr. H. J. Gorecki.

Secretary : J. A. MacD. Henderson.

Executive Committee : René Briend (Air France); Lord Douglas of Kirtleside (British European Airways); Sir Wilmot Hudson Fysh (Qantas Empire Airways); Croil Hunter (Northwest Airlines); Sir Leonard M. Isitt (Tasman Empire Airways); John C. Leslie (Pan American World Airways); Major J. Ronald McCrindle (B.O.A.C.); Gordon R. McGregor (Trans-Canada Airlines); Per A. Norlin (S.A.S.); Gregorio Obregon P (Aerovias Nacionales de Colombia); Prince Pacelli (Linee Aeree Italiane S.p.A.); Gilbert Périer (SABENA); Warren Lee Pierson (Trans World Airlines); Dr. A. Plesman (K.L.M.); M. Roushdy (Misrair); Dr. Paulo Sampaio (Panair do Brasil); J. R. D. Tata (Air India International); General C. J. Venter (South African Airways).

Financial Committee : Basil Smallpeice (B.O.A.C.), Chairman ; Dr. H. J. Gorecki, Secretary.

Legal Committee : René Golstien (SABENA), Chairman ; J. G. Gazdik, Secretary.

Medical Committee : Sir Harold Whittingham (B.O.A.C.), Chairman ; J. A. MacD. Henderson, Secretary.

Technical Committee ; Paul W. Goldsborough (T.W.A.), Chairman ; Stanislaw Krzyczkowski, Secretary.

Traffic Committee ; W. Gordon Wood (T.C.A.), Chairman ; A. Laurence Young, Secretary.

Chief Enforcement Officer : R. Feick.

Economics and Statistics Officer : Harold E. Shenton.

Legal Drafting Officer : W. M. Sheehan.

Public Relations Officer : S. Ralph Cohen.

Facilitation Officer : J. G. Gadzik (Acting).

Tariffs Officer : W. D. Barrington.

Manager of London Clearing House : A. J. Quin-Harkin.

European Technical Liaison Officer : Stanislav Krejcik.

Traffic Conference Secretaries : V. de Boursac (Paris); E. S. Pefanis (New York); H. M. Kingsley (Singapore).

The International Air Transport Association was formally inaugurated on April 19, 1945, at Havana, following a conference of international airline operators. Invitations to the conference and plans for the new organization were drawn up at a conference held in Chicago in December, 1944, on the initiative of the American Air Transport Association and attended by 34 representatives of 21 nations. The new Association succeeds the original International Air Traffic Association founded in 1919.

Headquarters of I.A.T.A. are at Montreal, Canada, and the association consists of a General Assembly and an Executive Committee, in which is vested the management of the association. The post of President is honorary.

The aims and objects of I.A.T.A. are to promote safe, regular and economical air transport ; to foster the development of air commerce, and to study all problems connected therewith ; to provide efficient machinery for collaboration among all air transport operators who are engaged directly or indirectly in international air transport service ; and to co-operate with the International Civil Aviation Organization (I.C.A.O.) and other international bodies.

There are two categories of membership—Active and Associate. Any air transport enterprise is eligible for active membership if it operates a scheduled air service under proper authority for the carriage of passengers, mail or cargo, between the territories of two or more States, under the flag of a State eligible to membership in the International Civil Aviation Organisation.

The Active Members are at June 1, 1953 :—*Aer Lingus Teoranta (Dublin); Aerolineas Argentinas (Buenos Aires); *Aerovias Guest, S.A. (Mexico City); Aerovias Nacionalas de Colombia AVIANCA (Bogotá); Aero O/Y (Helsinki); Aero Portuguesa (Lisbon); Air Algérie (Algiers); *Air Ceylon (Colombo); *Air France (Paris); *Air India International Ltd. (Bombay); Air Liban (Beirut, Lebanon); *American Airlines Inc. (New York); Aviación y Comercio (Madrid); Braniff Airways (Dallas); *British Commonwealth Pacific Airlines (Sydney); *British European Airways (London); *British Overseas Airways Corporation (London); *Canadian Pacific Air Lines (Vancouver); *Central African Airways Corporation (Salisbury, Southern Rhodesia); *Ceskoslovenske Aerolinie (Prague); Colonial Airlines (New York); Compañia Cubana de Aviación (Havana); Compañia Mercantil Anónima de Líneas Aéreas IBERIA (Madrid); *Cyprus Airways Limited (Nicosia); Delta-C&S Air Lines, Inc. (Atlanta); Divisáo de Exploracáo dos Transportes Aéreos DETA (Lourenço Marques); Divisáo de Exploracáo dos Transportes Aéreos DTA (Luanda); East African Airways (Nairobi); El Al Isreal Airlines (Tel Aviv); Empresa de Viação Aéreo Rio Grandense VARIG (Porto Alegre); Flugfelag Islands H.F. (Reykjavik); *Garuda Indonesian Airways (Djakarta); *Iraqi Airways (Baghdad); Jugoslovenske Aerotransport JAT (Belgrade); *KLM Royal Dutch Airlines (The Hague); Línea Aérea Nacional (Santiago, Chile); Línea Aeropostal Venezolana (Caracas); Linee Aeree Italiane, S.p.A. (Rome); Malayan Airways Limited (Singapore); Misrair SAE (Cairo); National Airlines Inc. (Miami); *National Greek Airlines TAE (Athens); *New Zealand National Airways Corp. (Wellington); *Northwest Airlines (St. Paul); *Panair do Brasil (Rio de Janeiro); *Pan American-Grace Airways (New York); *Pan American World Airways (New York); *Philippine Air Lines (Manila); Polish State Airlines LOT (Warsaw); *Qantas Empire Airways (Sydney); *Scandinavian Airlines System (Copenhagen, Oslo, Stockholm); Servicos Aéreos Cruzeiro do Sul (Rio de Janeiro); *Société Anonyme Belge d'Exploitation de la Navigation Aérienne SABENA (Brussels); *South African Airways (Johannesburg); *Swiss Air Transport Company (Zurich); *Tasman Empire Airways Ltd. (Auckland); *Transports Aériens Intercontinentaux (Paris); *Trans-Canada Air Lines (Montreal); Transportes Aéreos Portugueses (Lisbon); *Trans World Airlines Inc. (Kansas City); Union Aéromaritime de Transport (Paris); United Air Lines (Chicago); *West African Airways Corporation (Lagos, Nigeria).

(* Member of I.A.T.A. Clearing House.)

Associate membership may be obtained by any air transport concern operating an authorised scheduled air service under the flag of a State eligible for membership in the International Civil Aviation Organization. The Associate Member companies are :—*Australian National Airways (Melbourne); Deccan Airways (Begumpet); Eastern Air Lines (New York); and *Trans-Australia Airlines (Melbourne).

The creative work of I.A.T.A. is done largely by five Standing Committees—Financial, Legal, Medical, Technical and Traffic. Their affairs are administered by I.A.T.A.'s small secretariat who provide services for them and carry forward their recommendations. Rules for the conduct of the committees are laid down, and their decisions subject to final approval by the Executive Committee.

The Financial Committee has in its purview all financial matters connected with air transport ; standardization of methods of rendering ; verifying and settling accounts for revenue transactions between members ; aeronautical insurance matters ; introduction and control of money documents ; and statistical matters. An important step was the creation of the I.A.T.A. Clearing House, whose operations provide for the airlines an approach to an international currency. Set up to handle the inter-company revenue transactions of I.A.T.A. members, the Clearing House offsets their balances on a monthly basis and consolidates the result into a single monthly statement to each. Besides eliminating exchange risks and the costs involved in the ordinary settlement of these accounts the Clearing House makes it possible for its members to do business in both sterling and dollars.

An agreement was reached in May, 1948, for inter-clearance between I.A.T.A. and the Airlines Clearing House, Chicago. This arrangement between the two clearing houses enables the North American operators to accept bookings from soft currency areas, as well as from those countries which can pay in dollars, and to exchange business under the terms of the Universal Air Travel Plan.

The Legal Committee deals generally with legal matters having a bearing on international air transport, particularly with international conventions on public and private air law and on other means of transport ; with conflicts of law and with arbitration.

The Medical Committee has within its purview the physiological and psychological aspects of flight as they affect passengers and aircrew ; international sanitary regulations, etc.

The Technical Committee concerns itself with all international operational and engineering matters ; promotion of safety and efficiency in flight ; standardization of equipment and consumable spares ; unification of procedures ; radio and electronics ; meteorology ; maintenance of aircraft ; airways and ground aids. Once a year, the personnel of the Technical Committee and its four subcommittees hold a Technical Conference, in which the airlines of the world exchange technical information and recommend technical policy on an international basis. Government agencies, manufacturers, research establishments and other international organizations also participate in these Conferences.

I.A.T.A.'s technical branch has achieved a large measure of unification of operating practices as between the airlines themselves. An exchange of vital information about the causes of accidents and near accidents, as well as about other practical matters, is fruitfully carried on. I.A.T.A. technical delegations have also played a part in working out the allocation of frequencies for communications purposes voted by the International Telecommunications Union Conference, and have co-operated also with the International Meteorological Organization and others.

The Traffic Committee is concerned with all traffic matters involving passengers, cargo and the handling of mail. It continuously studies tariffs and schedules ; general conditions of carriage ; all matters pertaining to agents ; and the forms, documents and procedures used by the airlines themselves or required of them and their customers by governments. Recommendations of the Traffic Committee represent the best opinion of the whole industry, arrived at from the point of view of the worldwide air transport network.

Applying many of these recommendations to day-to-day operations over the whole world and under highly variable conditions, is a complicated and delicate task. The final recommendations on

rates and tariffs, conditions of carriage and agency matters are therefore left to Conferences, made up of the companies concerned actually providing service in any of the three following regions: I—North and South America, Greenland and the Hawaiian Islands; II—Europe, Africa and the Middle East, including Iran; and III—Asia, Australasia and the islands of the Pacific.

Within their terms of reference, the Traffic Conferences are autonomous. Their resolutions must be passed unanimously, and because of the high degree of public interest involved, they are subject to the approval of a number of governments.

This public concern applies particularly to the matters of rates and fares; a number of governments have, by international agreement or national law, recognized the Conference as agencies by which their various economic interests in international air transport can be fairly adjusted.

In traffic procedures and practices, the I.A.T.A. Traffic Committee and Conferences have achieved a degree of worldwide uniformity unprecedented in the history of transport. Two years of preparatory work, culminating in the first worldwide joint Traffic Conference meetings at Rio de Janeiro, in October, 1947, included the adoption of worldwide uniform tickets, air waybills, consignment notes and other documents; flight-line numbers and airline designators; conditions of carriage and agency agreements and resolutions; as well as the development of a worldwide rate structure. The three Conferences now meet in Composite session.

A basic part of the work of I.A.T.A. is daily co-operation with I.C.A.O. in the drafting of the latter organization's Standards and Recommended Practices, which set an international pattern for national technical regulation of aviation. Experts of I.A.T.A. member airlines and members of the I.A.T.A. Secretariat participate in all regional and divisional meetings of I.C.A.O., making available to the government organization the practical operating knowledge of the airlines. This technical work has been both intensive and extensive, covering all phases of technical operations and concerning itself with a multitude of details.

I.A.T.A. maintains close contact with I.C.A.O. in many other fields. Both organizations are vitally concerned in the campaign to facilitate international commerce by air, and I.A.T.A. has formed regional committees of airline operators to encourage government adoption of the I.C.A.O. Facilitation Standards.

Other organizations with whom I.A.T.A. maintains close working liaison include the Universal Postal Union, International Telecommunications Union, and other organizations in the fields in which air transport is interested.

I.A.T.A. has been commissioned by its members to issue certain publications on their behalf. Among these, the following are available to the interested public and may be ordered from the Head Office at Montreal:—

I.A.T.A. Bulletin. Published twice a year as the official record of the proceedings of the Association. $3.75 (U.S.) per year, $2.00 (U.S.) for the separate number.

Tabulation of Great Circle Distances. $5.00 (U.S.) per year, including 12 months' revision service.

Universal Interline Reservations Code. Given publication through various air guides.

I.A.T.A. Consolidated Tariffs. Various consolidated passenger and cargo rules and rates and unit conversion tariffs. Details available from I.A.T.A. Tariffs Office.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE (F.A.I.)

HEAD OFFICE: 6, RUE GALILÉE, PARIS, FRANCE.

President: C. Kolff (Netherlands).

Honorary Presidents: Mr. Godfrey L. Cabot, L.L.D., (U.S.A.); Lord Brabazon of Tara, M.C., P.C. (Great Britain) and Mr. William R. Enyart (U.S.A.).

First Vice-President: Capt. K. J. G. Bartlett, C.B.E. (Great Britain).

Vice-Presidents: General Medecin Ch. Sillevaerts (Belgium); General Piero Oppizzi (Italy); Miss Jacqueline Cochran (U.S.A. and Canada); Jacques Allez (France); Guirguis Awadalla (Egypt); Colonel Mihail Velimirovic (Yugoslavia); Don Luis F. Ardois and Don Oswaldo Gibelli (Central and South America); Dr. W. Muri (Central Europe); Mustafa Zeren (Turkey); Bertil Florman (Sweden); Don Vincente Gil Mendizabal (Spain); Jonkheer P. H. van de Wall Repelaer van Puttershoek (Netherlands); Colonel Pinheiro Correa (Portugal).

Director-General: H. R. Gillman, O.B.E.

Treasurer-General: Jean Blériot.

The *Fédération Aéronautique Internationale* was founded in Paris, in October, 1905. The countries represented at its foundation were Belgium, France, Germany, Great Britain, Italy, Spain, Switzerland, and the United States of America. The aim was co-operation between nations concerning aeronautics and with the development of aviation the F.A.I. has become the international representative body of world private aviation. The first record to be officially homologated by the F.A.I. was a speed record of 41.29 km.h. (25.06 m.p.h.) set up on November 12, 1906 by Alberto Santos Dumont. He was timed over a distance of 220 metres (721 feet), which was as far as he could then fly.

Before and between the two wars many international arrangements were made under the supervision of the F.A.I. and international rules and sports codes for private flying were drawn up. Most of the countries which were represented on the F.A.I. through their accredited national Aero Clubs have agreed to recognise the *Carnet de passages en Douane* making private flying between countries easier. Landing facilities and international sport and touring licences were introduced. The F.A.I. also played an important *rôle* in the development of gliding, soaring and model aircraft flying.

All World or National Records must be observed by a representative of a national Aero Club affiliated to the F.A.I. before such a record is homologated or approved by the F.A.I.

The F.A.I., through its *Commission Internationale de Tourisme Aérien* (C.I.T.A.) maintains the closest co-operation with I.C.A.O. through a liaison officer in Montreal.

The F.A.I. sits annually in general conference, but its various commissions sit more often. The last general conference was held at The Hague, from May 14-22, 1953.

The following is the list of national Aero Clubs, Federations or Associations which are affiliated to the F.A.I. (correct at June 1st, 1953):—

Argentina. Aero-Club Argentino, Rodriguez Peña 240, Buenos Aires.

Australia. The Aero-Club Federation of Australia, 108 Queen Street, Melbourne.

Austria. Oesterreichischer Aero Club, Dominikaner Bastei 24, Vienna.

Belgium. Aéro-Club Royal de Belgique, 53 Avenue des Arts, Brussels.

Bolivia. Aero-Club Boliviano, La Paz.

Brazil. Aero-Clube do Brasil, Rua Alvaro Alvim 31, Rio de Janeiro.

Canada. The Royal Canadian Flying Clubs Association, 309 Journal Building, Ottawa.

Colombia. Aero Club de Colombia, Edificio Narino, Avenue Jimenez de Quesada 11-28, Bogota.

Cuba. Club de Aviacion de Cuba, Edificio Larrea, 206, Havana.

Czechoslovakia. Aeroklub Republiky Ceskoslovenské, Smecky 22, Prague.

Denmark. Det Kongelig Dansk Aeroklub, Osterbrogd 40, Copenhagen.

Ecuador. Aero Club del Ecuador, Casilla 348, Guayaquil.

Egypt. Royal Aero-Club d'Egypte, 26 Rue Cherif Pacha, Cairo.

Finland. Suomen Ilmailuliito, Mannerheimintie 16, Helsinki.

France. Aéro-Club de France, 6 Rue Galilée, Paris.

German Federal Republic. Deutscher Aero-Club, Taunusanlag 20, Frankfurt-au-Main.

Great Britain. The Royal Aero Club of the United Kingdom, 119 Piccadilly, London, W.1.

Greece. Royal Aero Club of Greece, 35 Jan Smuts Street, Athens.

Hungary. Magyar Repulo Szovetzeg, V. Sztalin-tér 14, Budapest.

Iceland. Flugmalafelag Islands, Reykjavik Airport, Reykjavik.

India. Aero Club of India, P.O. Box No 68, New Delhi.

Ireland. Irish Aviation Club, Coonagh Airfield, Coonagh, County Limerick.

Israel. The Aero Club of Israel, 9 Montefiore Street, P.O.B.1311, Tel-Aviv.

Italy. Aero-Club d'Italia, Via Cesare Beccaria 35, Rome.

Luxembourg. Aero-Club du Grand Duché de Luxembourg, 5 Avenue Monterey, Luxembourg.

Mexico. Aero-Club de Mexico, Versales 14, Mexico City.

Monaco. Monaco Air-Club, 8 Rue Grimaldi, Monaco.

Netherlands. Koninklijke Nederlandse Vereniging Voor Luchtvaart, 3 Anna Paulownaplein, The Hague.

New Zealand. Royal New Zealand Aero Club, 39 Johnston Street, Wellington C.I.

Norway. Norsk Aero-Klubb, Ovre Vollgate 7, Oslo.

Peru. Aero-Club del Peru, Baquijano 722, Lima.

Poland. Aeroklub Rzecypospolitej Polskiej, ul Orgodowa 65, Warsaw.

Portugal. Aero Club de Portugal, Avenida da Liberdade 226, Lisbon.

Saar. Aero Club Saar, Elsasserstrasse 2, Saarbrücken.

South Africa. The Aero Club of South Africa, P.O. Box 2312, Johannesburg.

Soviet Union. Aero-Club Central de l'U.S.S.R., V. P. Tchkalov, Moscow.

Spain. Real Aero-Club de España, Carrera de San Jeronimo 19, Madrid.

Spanish Guinea. Aero-Club de Guinée, Avenida del Generalissimo No. 5, Santa Isabel 2, Fernando Poo.

Spanish Morocco. Aero-Club de Tetuan, Muley Abselam No. 2, Tetuan.

Sweden. Kungl. Svenska Aeroklubben, Malmskillnadsgatan 27, Stockholm.

Switzerland. Aero-Club der Schweiz, Hirschengraben 22, Zurich.

Turkey. Turk Hava Kurumu, Enstitü Caddesi 1, Ankara.

United States. National Aeronautic Association of U.S.A., 1025 Connecticut Avenue, Washington D.C.

Uruguay. Aero-Club del Uruguay, Paysandú 896, Montevideo.

Venezuela. Féderacion Venezolana de Aeronautica, Edificio Ayacucho 4° Piso, Conde a Padre Sierra, Caracas.

Yugoslavia. Union Aéronautique Yougoslave, Uzun Mirkova 4, Belgrade.

WORLD'S RECORDS

Homologated by the Fédération Aéronautique Internationale.

ABSOLUTE RECORDS IRRESPECTIVE OF CLASS

Speed (U.S.A.).
Lieut. Col. W. F. Barns, U.S.A.F., in a North American F-86D. Salton Sea, California. July 16, 1953. 1,145.184 km.h. (715.74 m.p.h.).

Altitude (U.S.A.).
Capt. O. A. Anderson and Capt. A. W. Stevens in the balloon "Explorer II." November 11, 1935. 22,066 m. (72,376 ft.).

Distance in Straight Line (U.S.A.).
Cdr. T. D. Davies, Cdr. E. P. Rankin, Cdr. S. Reid, Lieut. Cdr. R. A. Tabeling, U.S.N. in a Lockheed P2V-1. Perth, Australia, to Columbus, Ohio, U.S.A. September 29-October 1, 1946. 18,081.990 km. (11,228.915 miles).

Distance in Closed Circuit (U.S.A.).
Lieut. Col. Lassiter and Capt. W. J. Valentine, U.S.A.F. in a Boeing B-29. August 1-3, 1947. 14,249.656 km. (8,849 miles).

RECORDS BY CLASS

The following Classes are recognised by the F.A.I. for record purposes):— Class A (Spherical Balloons), Class B (Dirigibles), Class C (Powered Aircraft), Class D (Motorless Aircraft) and Class E (Rotary-wing Aircraft). Listed below are the principal records for Speed, Altitude and Distance in Classes C, D and E. Classes A and B, for which no records have been claimed since 1941, are not included.

CLASS C (POWERED AIRCRAFT).

1—Aircraft fitted with piston engines.

Speed (Germany).
Fritz Wendel in a Messerschmitt Bf 109R. Augsberg. April 26, 1939. 755.138 km.h. (468.94 m.p.h.).

Altitude (Italy).
Mario Pezzi in a Caproni 161*bis*. Montecelio. October 22, 1938. 17,083 m. (56,032.2 ft.).

Distance in Straight Line (U.S.A.).
As Absolute Record (see prev. col.)

2—Aircraft fitted with jet engines.

Speed (U.S.A.).
As Absolute Record (see prev. col.)

Altitude (Great Britain).
Wing Cdr. W. F. Gibb in an English Electric Canberra (two Bristol Olympus turbojets). Filton, Bristol. May 4, 1953. 19,418.7 m. (63,668 ft.).

CLASS C*bis* (SEAPLANES.)

Speed (Italy).
Francesco Agello in a Macchi M.C. 72 seaplane. Descenzano. October 23, 1934. 709.209 km.h. (440.42 m.p.h.).

Altitude (Italy).
Lieut. Col. N. di Mauro in a Caproni 161*bis* seaplane. Vigna di Valle. September 25, 1939. 13,542 m. (44,417.7 ft.).

Distance in Straight Line (Great Britain).
Capt. D. C. T. Bennett and 1st Officer I. Hervey in Short-Mayo "Mercury" seaplane (composite launch). Dundee, Scotland, to Port Nolloth, South Africa. October 6-8, 1938. 9,652 km. (5,993.8 miles).

CLASS D (MOTORLESS AIRCRAFT).

1—Single-seat sailplanes.

Duration (France).
Charles Atger in an Arsenal Air-100. Romanin les Alpilles. April 2-4, 1952. 56 hours, 15 min.

Distance in Straight Line (U.S.A.).
Richard H. Johnson in a Ross-Johnson. From Odessa, Texas, to Salina, Kansas. August 5, 1951. 861.272 km. (534.85 miles).

Absolute Height (U.S.A.).
W. S. Ivans, Jr. in a Schweizer SGS 1-23. Bishop, California. December 30, 1950. 12,832 m. (42,088.96 ft.).

2—Multi-seat sailplanes.

Duration (France).
A. Carraz and J. Branswick in a Castel-Mauboussin C.M.7. Romanin les Alpilles. February 4-6, 1952. 53 hours, 4 min.

Distance in Straight Line (U.S.S.R.).
I. Kartachev and P. Savtzov in a "Stakhanovetz." Moscow to Ouchnia. July 17, 1938. 619.748 km. (384.86 miles).

Absolute Height (U.S.A.).
Lawrence E. Edgar and Harold E. Klieforth in Pratt-Read G.I. Bishop, Cal. March 19, 1952. 13,489 m. (44,243.9 ft.).

CLASS G (ROTARY-WING AIRCRAFT).

Distance in Straight Line (U.S.A.).
Elton J. Smith in a Bell 47D1. Fort Worth, Texas, to Niagara Falls, N.Y. September 17, 1952. 1,958.796 km. (1,216.4 miles).

Altitude (U.S.A.).
Capt. H. D. Gaddis in a Sikorsky S-52-1. Bridgeport, Conn. May 21, 1949. 6,468 m. (21,215 ft.).

Speed (U.S.A.).
Harold E. Thompson in a Sikorsky S-52-1. Cleveland, Ohio. April 27, 1949. 208.494 km.h. (129.47 m.p.h.).

Point-to-Point Speed Records

The following are the principal Point-to Point Speed Records which have been homologated by the F.A.I. since 1945.

Gibraltar-London (Great Britain).
Group Capt. A. C. P. Carver, R.A.F. in a D.H. Hornet F. Mk. 3. September 19, 1949. Time : 2 hrs. 30 min. 21 sec. Speed : 701.492 km.h. (435.62 m.p.h.).

Havana-Washington (U.S.A.).
W. W. Edmondson in a North American F-51. November 27, 1947. Time : 3 hrs. 15 min. 13 sec. Speed : 563.800 km.h. (350.1 m.p.h.).

Washington-Havana (U.S.A.).
W. W. Edmondson in a North American F-51. November 25, 1947. Time : 3 hrs. 37 min. 28 sec. Speed : 506.092 km.h. (314.28 m.p.h.).

London-Rome (Great Britain).
John Cunningham, Peter Bugge and others in D.H. Comet. March 16, 1950. Time : 1 hr. 59 min. 37 sec. Speed : 719.730 km.h. (446.95 m.p.h.).

Rome-London (Great Britain).
John Cunningham, Peter Bugge and others in D.H. Comet. March 16, 1950. Time : 1 hr. 58 min. 4 sec. Speed : 729.530 km.h. (455.04 m.p.h.).

London-Copenhagen (Great Britain).
Janusz Zurakowski in a Gloster Meteor 8. April 4, 1950. Time : 1 hr. 5 min. 5 sec. Speed : 871.344 km.h. (541.10 m.p.h.).

London-Copenhagen-London (Great Britain).
Janusz Zurakowski in a Gloster Meteor 8. April 4, 1950. Time : 2 hrs. 29 min. 8 sec. Speed : 770.202 km.h. (480.29 m.p.h.).

Copenhagen-London (Great Britain).
Janusz Zurakowski in a Gloster Meteor 8. April 4, 1950. Time : 1 hr. 11 min. 17 sec. Speed : 805.752 km.h. (500.37 m.p.h.).

London-Brussels (Great Britain).
D. A. Morgan in a Supermarine Swift Mk. 1. July 10, 1952. Time : 18 min. 3.3 sec. Speed : 1,065.44 km.h. (665.9 m.p.h.).

London-Cairo (Great Britain).
John Cunningham and others in D.H. Comet. April 24, 1950. Time : 5 hrs. 6 min. 58 sec. Speed : 686.558 km.h. (426.35 m.p.h.).

Cairo-London (Great Britain).
John Cunningham and others in D.H. Comet. May 11, 1950. Time : 5 hrs. 39 min. Speed : 621.026 km.h. (385.656 m.p.h.).

London-Karachi (Great Britain).
Flt. Lieuts. L. M. Whittington and J. A. Brown, R.A.F., in an English Electric Canberra. January 27, 1953. Time : 8 hrs. 52 min. Speed : 711.085 km.h. (441.583 m.p.h.).

London-Darwin (Great Britain).
Flt. Lieuts. L. M. Whittington and J. A. Brown, R.A.F., in an English Electric Canberra. January 27-28, 1953. Time : 22 hrs. Speed : 629.553 km.h. (390.971 m.p.h.).

London-Wellington, New Zealand (Great Britain).
Air Cdre. N. H. d'Aeth, Sq. Ldr. J. S. Aldridge, Flt. Lt. D. D. Hurditch, R.A.F. in Avro Lancaster "Aries." August 21-24, 1946. Time : 59 hrs. 50 min. Speed : 313.270 km.h. (194.54 m.p.h.).

London-Malta (Great Britain).
Lieut. Cdr. W. R. McWhirter and Lieuts. P. C. S. Chilton, D. A. Hook and D. W. Morgan, R.N. in four Hawker Fury 11's. July 19, 1949. Time : 3 hrs. 20 min. 49 sec. Speed 624.260 km.h. (387.66 m.p.h.).

London-Tripoli (Great Britain).
Sq. Ldr. L. C. E. De Vigne and Flt. Lieut. P. A. Hunt, R.A.F. in an English Electric Canberra Mk. 2. February 2, 1952. Time : 2 hrs. 41 min. Speed : 866.021 km.h. (537.79 m.p.h.).

London-Cape Town (Great Britain).
Sq. Ldr. H. E. Martin and Sq. Ldr. E. B. Sismore, R.A.F., in a D.H. Mosquito P.R. Mk. 34. April 30-May 1, 1947. Time : 21 hrs. 31 min. 30 sec. Speed : 449.400 km.h. (279 m.p.h.).

London-Paris (Great Britain).
M. J. Lithgow in a Supermarine Swift F. Mk. 4. July 5, 1953. Time : 19 min. 5.6 sec. Speed : 1,077.417 km.h. (669.3 m.p.h.).

New York-Los Angeles (U.S.A.).
Capt. B. L. Grubaugh and Capt. J. L. England, U.S.A.F. in a Boeing B-29. August 1, 1946. Time : 7 hrs. 28 min. 3 sec. Speed : 528.828 km.h. (328.4 m.p.h.).

Los Angeles-New York (U.S.A.).
Colonel W. H. Councill, U.S.A.F. in a Lockheed F-80. January 26, 1946. Time: 4 hrs. 13 min. 26 sec. Speed : 934.926 km.h. (580.59 m.p.h.).

Belfast-Gander (Great Britain).
R. P. Beamont, D. A. Watson and R. Rylands in an English Electric Canberra Mk. 2. August 31, 1951. Time : 4 hrs 18 min. Speed : 774.255 km.h. (480.81 m.p.h.).

Belfast-Gander-Belfast (Great Britain).
R. P. Beamont, P. Hillwood and D. A. Watson in an English Electric Canberra. August 26, 1952. Time : 10 hrs. 3 min. Speed : 663.038 km.h. (399.81 m.p.h.).

Gander-Belfast (Great Britain).
R. P. Beamont, P. Hillwood and D. A. Watson in an English Electric Canberra. August 26, 1952. Time : 3 hrs. 25 min. Speed : 974.503 km.h. (605.166 m.p.h.).

London-Nairobi (Great Britain).
Wing Cdr. H. P. Conolly, Air Chief Marshal Sir Hugh Lloyd and Sq. Ldr. D. Chase, R.A.F., in English Electric Canberra. September 28, 1952. Time : 9 hrs. 55 min. Speed : 687.611 km.h. (427 m.p.h.).

THE AIRLINES OF THE WORLD

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
ADEN							
Aden Airways Ltd.	Khormaksar Airport, Aden Chairman: Sir Miles Thomas Man. Dir.: R. de Graaff Hunter	6 Douglas DC-3	5,500	1,897,137	26,894	Freight: 2,322,880 lb. Mail: 190,400 lb.	A wholly-owned subsidiary of B.O.A.C.
ALASKA							
Alaska Airlines, Inc.	2320, Sixth Avenue, Seattle, Wash. Chairman: R. W. Marshall Pres.: Nelson David Vice-Pres., Ops.: Jack Peck	2 Douglas DC-4 4 Douglas DC-3 3 Curtiss Commando 17 smaller aircraft	6,000 plus	2,924,672	34,926	Freight: 7,842,240 lb. Mail: 2,499,840 lb.	Fleet as at March 1, 1953
Alaska Coastal Airlines	2, Marine Way, Juneau Joint Man.: S. B. Simmons and O. F. Benecke	1 Convair Catalina amph. 6 Grumman Goose 2 Grumman Widgeon 1 Lockheed Vega 1 Bellanca CH-300 1 Republic Seabee 1 Aeronca Super Chief	2,607	768,845	35,600	106,803 ton-miles	A co-partnership of Alaska Air Transport, Inc. and Marine Airways Corpn., each holding a substantially equal interest. Fleet as at March 1, 1953.
Alaska Island Airlines	Petersburg Pres.: J. Nolan Co-Man.: Q. L. DeBoer and K. J. Omdahl	Grumman Widgeon Waco Aeronca	—	—	—	—	Operates a scheduled service between Petersburg-Juneau-Wrangell-Ketchikan.
Bristol Bay Airlines	Dillingham Owner and Operator: Robert D. Fenno Traffic Man.: Thos. V. Lamirand	2 Stinson Station Wagon 2 Bellanca Sky Rocket 1 Cessna T-50	—	—	—	—	Operates eight scheduled services in the Bristol Bay area.
Byers Airways, Inc.	Box 1410, Fairbanks Pres.: Robert D. Byers Vice-Pres.: Gladys Byers Ops. Man.: J. H. Stevenson	1 Cessna T-50 1 Stinson Reliant 1 Howard GH-2 1 Cessna 170 1 Piper Pacer Seaplane	1,207	—	—	—	Certified U.S. mail carrier.
Christensen Air Service	Anchorage Owner and Operator: Hakon Christensen	1 Grumman Widgeon 1 Waco Aristocrat	—	—	—	—	Operates a scheduled service between Anchorage and Seward.
Cordova Airlines, Inc.	P.O. Box 1499, Anchorage Pres.: Merle K. Smith	1 Douglas DC-3 1 Grumman Goose 3 Cessna 170 2 Piper PA-14 1 Stinson V-77 1 Stinson Junior 1 Stinson SR9	—	84,629 traffic ton-miles	—	—	Operates scheduled services to thirteen points in Alaska.
Ellis Air Lines	Box 1059, Ketchikan Pres.: R. E. Ellis	6 Grumman Goose 3 Aeronca Sedan	454	605,430	40,511	1,588,160 lb.	Fleet as at March 1, 1953.
Munz Air Service	P.O. Box 639, Nome Owner and Operator: William S. Munz	3 Stinson 2 Howard	—	—	—	—	Scheduled operator
Northern Consolidated Airlines, Inc.	Anchorage International Airport, Anchorage Pres.: Raymond I. Petersen Vice-Pres., Ops.: R. J. Stevenson Traffic Man.: Victor R. Davis	3 Douglas DC-3 1 Convair Catalina amph. 4 Stinson Reliant 4 Noorduyn Norseman 10 Cessna T-50	2,044	1,072,009	19,799	3,980,480 lb.	—
Pacific Northern Airlines, Inc.	Anchorage Pres. and Gen. Man.: A. G. Woodley Vice-Pres., Ops.: C. A. DuRose	2 Douglas DC-4 4 Douglas DC-3 1 Lockheed 12 2 Various	6,175	6,719,773 traffic ton-miles	—	—	-
Reeve Aleutian Airways, Inc.	P.O. Box 559, Anchorage Pres.: Robert C. Reeve	3 Douglas DC-3 2 Sikorsky S-43 1 Grumman Goose 1 Boeing 80-A 2 Fairchild 71	1,783	2,828,000*	3,529*	Freight:* 39,000 ton-miles Mail: 76,000 ton-miles	*Figures for 1951.
Safeway Airways	Merrill Field, Anchorage Owner and Operator: Gentry W. Shuster	1 Grumman Widgeon 3 Stinson Station Wagon 1 Piper Pacer 1 Piper Cub	—	—	—	—	Scheduled operator
Wien Alaska Airlines, Inc.	P.O. Box 649, Fairbanks Pres.: Sigurd Wien Vice-Pres.: George B. Rayburn	1 Curtiss Commando 3 Douglas DC-3 15 Single-engined aircraft	6,577	1,485,016	10,795	618,598 ton-miles	

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
ALGERIA							
Compagnie Air-Algérie	Shell Buildings, 46, Boulevard Saint-Saens, Algiers Pres.: J. Lignel Gen. Man.: Leon Adida	1 Breguet Deux Ponts 6 S.O. 30P Bretagne 5 Douglas DC-3	3,135	2,536,165	80,804	—	Merged with Compagnie Air Transport (C.A.T.) on May 21, 1953, to form Compagnie Générale de Transport Aérien (C.G.T.A.)—Air-Algérie, and now remains only as a holding company in the new concern.
Compagnie Air Transport (C.A.T.)	Avenue Hoche 5, Paris 8e Chairman and Man. Dir.: Jean Richard-Deshais Vice-Chairman: Jean Lignel Dep. Man. Dir.: Léon Adida	3 Douglas DC-4 3 Douglas DC-3	N.A.	2,681,230	91,358	Freight: 4,714,600 lb. Mail: 39,600 lb.	Merged on May 21 1953, with Air Algérie to form Compagnie Générale de Transport Aérien-Air Algérie.
ANGLO-EGYPTIAN SUDAN							
Sudan Airways	P.O. Box 253, Sirdar Avenue, Khartoum Gen. Man.: D. P. Paton Traffic Supr.: A. G. Leuchars	5 D.H. Dove 1 Auster *On order:* 2 Douglas DC-3 for delivery in 1953	3,008	818,675	8,842	Freight: 241,287 lb. Mail: 49,027 lb.	Operated as a department of the Sudan Government.
ARGENTINA							
Aerolineas Argentinas	Avendida Paseo Colon 185, Buenos Aires Gen. Man.: Dirk Wessels van Leyden Ops. Dir.: Angel Raul Vaccari	6 Douglas DC-6 6 Douglas DC-4 20 Douglas DC-3 5 Convair 240 6 Short Sandringham	31,762	8,416,415	210,992	—	Forms part of the Empresa Nacional del Transporte, a State organisation which controls all transport in Argentina.
Lineas Aereas del Estado (L.A.D.E.)	Corrientes 480, Buenos Aires Dir.: Brigadier Eduardo Pacifico Correa Gen. Man.: Mario Sanchez Claria	Douglas DC-4 Douglas DC-3 Vickers Viking	1,883	—	—	—	Operated by the Argentine Air Force.
AUSTRALIA							
Airlines (W.A.) Ltd.	55, St. George's Terrace, Perth, W.A. Chairman: E. S. Saw Man. Dir.: J. W. Cameron	3 D.H. Dove 4 Avro Anson	5,236*	1,130,754	14,335	533,120 lb.	*As at March 31, 1953.
Albury Air Services	Albury, N.S.W.	—	—	—	—	—	Operates scheduled service Albury - Holbrook - Wagga.
Ansett Airways Pty. Ltd.	Commonwealth Aerodrome, Essendon, Melbourne, Vic. Man. Dir.: R. M. Ansett Gen. Man.: R. D. Collins Ops. Man.: B. S. Brown	6 Douglas DC-3	2,099	2,894,321	147,946	Freight: 5,016,976 lb. Mail: 8,757 lb.	Ansett Flying Boat Services Pty. Ltd., is a subsidiary company in which a 66⅔% interest is held. Ansett recently purchased the remaining assets of Trans-Oceanic Airways (Pty.) Ltd.
Australian National Airways Pty. Ltd. (A.N.A.)	390, Flinders Street, Melbourne, Vic. Man. Dir.: I. N. Holyman Ops. Man.: G. H. Archibald	9 Douglas DC-4 28 Douglas DC-3 3 Bristol Freighter	14,500	15,999,678	621,203	70,902,661 lb	Have operational control of Townsville and Country Airways, hold controlling interest in Guinea Airways, Ltd. and are shareholders in Air Ceylon and Air Beef.
Barrier Reef Airways Pty., Ltd.	Hamilton Flying-boat Base, Brisbane, Queensland Chairman of Board: R. M. Ansett Man. Dir.: Stewart C. Middlemiss Ops. Man.: B. W. Monkton	2 Short Sandringham Mk. 4 2 Convair Catalina	1,468				Owned by Ansett Transport Industries (parent of Ansett Airways Ltd.).
British Commonwealth Pacific Airlines Ltd. (B.C.P.A.)	53, Martin Place, Sydney, N.S.W. Chairman: G. P. N. Watt Gen. Man.: A. A. Barlow	4 Douglas DC-6 *On order:* 3 D.H. Comet Series 2 for delivery in 1954	9,749	2,467,756	15,752	338,240 lb.	Jointly owned by the Governments of Australia (50%), New Zealand (30%) and the United Kingdom (20%). Fleet as at March 31, 1953
Butler Air Transport Ltd.	Kingsford-Smith Airport, Sydney, N.S.W. Man. Dir.: C. A. Butler	6 Douglas DC-3 1 D.H. Heron	6,075	1,773,121	125,122	2,204,728 lb.	Queensland Airlines Pty. Ltd. is a subsidiary. Fleet as at Mar. 5, 1953.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
AUSTRALIA—*cont.*							
Connellan Airways Ltd.	Townsite Aerodrome, Alice Springs, N.T. Pres.: E. J. Connellan Man.: R. M. Power	3 D.H. Rapide 2 D.H. Dragonfly 2 D.H. Tiger-Moth 1 Auster Aiglet 1 Beechcraft D17S	8,000	250,200	1,283	Freight: 78,624 lb. Mail: 64,960 lb.	Fleet as at March 1, 1953.
East-West Airlines Ltd.	P.O. Box 249, Tamworth, N.S.W. Chairman: D. M. Shand Gen. Man.: A. J. Smith	3 Lockheed Hudson	1,034	500,000	26,000	525,000 lb.	—
Guinea Airways Ltd.	Airways House, 132, North Terrace, Adelaide, S.A. Chairman: S. Powell	3 Douglas DC-3 1 Auster Autocar	1,656	752,897	81,548	2,173,494 lb.	—
MacRobertson-Miller Aviation Co. Pty. Ltd.	194, St. George's Terrace, Perth, W.A. Man. Dir.: H. C. Miller	3 Douglas DC-3 1 Lockheed Electra 5 Avro Anson	10,600	1,536,368	25,785	1,996,899 lb.	Air Beef Pty. Ltd. is an affiliated company. Fleet as at March1, 1953.
Overland Air Services (Pty.), Ltd.	Hangar 2, Kingsford Smith Airport, Sydney, N.S.W. Traffic Man.: O. R. Sage	2 Lockheed Lodestar 2 Avro Anson *On order;* 2 Lockheed Electra	522	—	—	—	Scheduled feeder services.
Qantas Empire Airways Ltd. (Q.E.A.)	Shell House, Carrington Street, Sydney, N.S.W. Chairman and Man. Dir.: Sir Wilmot Hudson Fysh Gen. Man.: C. O. Turner Ops. Man.: W. H. Crowther	6 Lockheed Constellation 5 Douglas DC-4 4 Short Sandringham 13 Douglas DC-3 4 D.H. Drover 7 D.H. Dragon 4 Convair Catalina 2 Avro Lancastrian *On order;* 7 Lockheed Super Constellation 1049C—1954-5 6 Bristol Britannia Mk. 300—1956-7	61,501	9,968,872	94,624	10,025,949 lb.	Owned by the Australian Government.
Queensland Airlines Pty. Ltd.	Eagle Farm Airport, Brisbane, Queensland Chairman: D. S. Aarons Man. Dir.: R. S. Adair	2 Douglas DC-3	2,855	653,500	40,415	1,023,008 lb.	Subsidiary of Butler Air Transport Ltd.
South Coast Airways Pty. Ltd.	Box 151, Port Kemble Road, Wollongong, N.S.W. Man. Dir.: W. E. James	Douglas DC-3 1 Lockheed Electra 3 Avro Anson 1 Desoutter 3 D.H. Tiger Moth	508	—	—	—	Scheduled feeder services.
Townsville and Country Airways (Pty.) Ltd.	41, Flinders Street, Townsville, Queensland Man.: J. H. Woolrych	1 Douglas DC-3	515	N.A.	N.A.	N.A.	Operates service between Townsville and Mount Isa with aircraft hired from Australian National Airways (Pty.) Ltd.
Trans-Australia Airlines (T.A.A.)	339, Swanston Street, Melbourne, Vic. Chairman: G. P. N. Watt Gen. Man.: L. J. Brain Ops. Man.: J. Chapman	4 Douglas DC-4 20 Douglas DC-3 5 Convair 240 4 Bristol Freighter 2 Lockheed Lodestar 4 D.H. Drover 4 D.H. Dragon	24,828	15,726,737	659,752	Freight: 29,894,280 lb. Mail: 2,978,905 lb.	Company is State-owned.
Woods Airways Pty. Ltd.	Airways House, 88, St. George's Terrace, Perth, W.A. Man. Dir.: James Woods	2 Avro Anson	25	—	—	—	Operates the shortest scheduled airline route in the world, between Perth and Rottnest Island.
BAHREIN							
Gulf Aviation Co., Ltd.	Bahrein, Persian Gulf Chairman: G. Beeby-Thompson Exec. Dir.: G. F. W. Parker	4 D.H. Dove	N.A.	59,400 traffic ton-miles	N.A.	N.A.	A partially-owned subsidiary of B.O.A.C. Fleet as at March 1, 1953.
BELGIUM							
Société Anonyme Belge d'Exploitation de la Navigation Aérienne (SABENA)	145, rue Royale, Brussels Pres.: Gilbert Périer Man. Dir.: Gaston Claeys Ops. Man.: Anselme V. J. Vernieuwe	6 Douglas DC-6B 5 Douglas DC-6 7 Douglas DC-4 26 Douglas DC-3 6 Convair 240 4 D.H. Dove 3 Bell Model 47 D1 (Internal Air Mail Services) *On order,* 3 Sikorsky S-55 for delivery in Summer 1953 2 Douglas DC-6A 2 Douglas DC-6B for delivery in 1954	50,000	13,277,065	277,028	5,028,307 lb.	Owned by the Belgian Government and private interests each holding 50% of the shares. Fleet as at March 15, 1953.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
BELGIUM							
Société Belge de Transports par Air S.A. (Sobelair)	Rue Royale 137, Brussels	5 Douglas DC-3	—	—	3,564	—	Private company operating passenger and freight services between Belgium and the Belgian Congo.
BOLIVIA							
Lloyd Aéreo Boliviano S.A. (L.A.B.)	Casilla 132, Cochabamba Pres.: Augusto Céspedes Gen. Man.: Cmdte. Walter Lehm Sup. Ops.: Alfonso Ibanez	11 Douglas DC-3 4 Boeing B-17 *On order:* 2 Douglas DC-3	6,575	1,863,833	75,087	29,878,059 lb.	Fleet as at April 30, 1953.
BRAZIL							
Aéro Geral Ltda.	Avenida Franklin Roosevelt 194, Rio de Janeiro Dir.: Apolonio Pinto	3 Douglas DC-3 2 Curtiss Commando	1,572	—	—	—	A wholly-owned subsidiary of V.A.R.I.G.
Companhia Itau de Transportes Aéreos	Rua Asdrubal do Nascimento 436, São Paulo Div. Pres.: Dr. Jorge Dias Oliva Div. Vice-Pres.: Dr. Manuel I. A. Castilho Chief, Ops.: Carlos Alberto Klotz	9 Curtiss Commando	4,157	—	—	—	Freight services only.
Consorcio Loide Aéreo Nacional S.A. (LOIDE)	Avenida 13 de Maio, 13-27° andar, Rio de Janeiro Pres.: Gen. João Mendonca Lima Gen. Man.: Col. Marcilio Gibson Jacques Ops. Man.: A. Vianna	Douglas DC-3's Curtiss Commando's	6,090	—	—	—	A consortium of Loide Aereo Nacional S.A., Linhas Aéreas Paulistas (L.A.P.) and Transportes Aéreos Bandeirantes Ltda (T.A.B.A.).
Consorcio Nacional de Transportes Aéreos (Nacional)	Avenida General Justo 275, anexo 13, 7° andar Rio de Janeiro Dir.: A. O. G. de Britto	Douglas DC-3's	16,250	—	—	—	A consortium of Central Aérea Ltda., Organisação Mineira de Transportes Aéreos (O.M.T.A.), Transportes Aéreos Nacional Ltda. and Viação Aérea Brasil S.A.
Empresa de Transportes Aéreos Catarinense S.A. (T.A.C.)	Felipe Schmidt 14, Florianopolis, Santa Catarina Pres.: Dr. João David Ferreira Lima Vice-Pres.: Genesio de Miranda Lins	Douglas DC-3's *On order:* 3 DC-3's	964	—	—	—	Operates with assistance from Cruzeiro do Sul.
Empresa de Transportes Aéreos Norte do Brasil Ltda. (Aéronorte)	Avenida Pedro II, 58-D, São Luiz, Maranhao	7 Percival Prince	3,750	—	—	—	Operates an extensive feeder network.
Empresa de Transportes Aéreo-vias Brasil S.A. (Aérovias)	Avenida Ipiranga 1248, São Paulo Pres.: Col. Eleutherio B. Ferlich Ops. Man.: Nivaldo Rocha	3 Douglas DC-4 22 Douglas DC-3 4 Curtiss Commando *On order:* 20 Nord 2501 Noratlas	33,908	7,243,486	222,694	Freight: 8,136,249 lb. Mail: 372,830 lb.	Empresa de Transportes Aéreos Norte do Brasil Ltda. is a wholly-owned subsidiary.
Navegacão Aérea Brasileira S.A. (N.A.B.)	Santos-Dumont Airport, Rio de Janeiro	Douglas DC-3's	700	—	—	—	—
Panair do Brasil S.A. (P.A.B.)	Santos Dumont Airport, Rio de Janeiro Pres.: Paulo Sampaio Gen. Man.: Cauby C. Araujo	5 Lockheed Constellation L-49 17 Douglas DC-3 5 Convair Catalina (amph.) *On order:* 4 D.H. Comet Series 2 for delivery in 1954-5	48,522	6,700,838	326,246	8,278,780 lb.	An associated company of P.A.W.A.
S.A. Empresa de Viação Aérea Rio Grandense (V.A.R.I.G.)	Avenida Borges de Medeiros 453, Porto Alegre Pres. and Man.: Rubem M. Berta Vice-Pres.: Oscar Siebel Chief Ops.: Damiao F. Kluwe	22 Douglas DC-3 13 Curtiss Commando 2 Lockheed Electra *On order:* 10 Curtiss Commando 3 Lockheed Super Constellation L-1049C delivery 1955	3,412	5,590,245	270,331		
S.A. Transportes Aéreos (R.E.A.L.)	Rua Conselheiro Crispiniano, 379-8° andar, São Paulo Pres.: Dr. Sebastião Paes de Almeida Ops. Dir.: Capt. Armando de Aguiar Campos	28 Douglas DC-3 4 Curtiss Commando *On order:* 4 Convair 340 for delivery in 1954	5,615	—	—	—	—

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
BRAZIL—*cont.*							
S.A. Viação Aérea Gaucha (S.A.V.A.G.)	Edificio Camara do Comercio, Rio Grande do Sul Pres.: Erwin Carneiro Becker Vice-Pres.: Vasco Vieira da Fonseca Man.: Willy Fritz Weick	Douglas DC-3's	633	—	—	—	Cruzeiro do Sul renders administrative and technical assistance.
Servicos Aéreos Cruzeiro do Sul Ltda. (Cruzeiro)	Avenida Rio Branco 128, P.O. Box 190, Rio de Janeiro Pres.: Dr. José Bento Ribeiro Dantas Dir. Ops.: Brig. Franklin A. Rocha Ops. Supt.: Oswaldo Mueller	2 Douglas DC-4 31 Douglas DC-3 6 Beechcraft AT-11 *On order:* 4 Convair 340	20,442	9,490,745	301,891	—	—
Transportes Aéreos Salvador Ltda. (T.A.S.)	Avenida Joana Angelica 8, Salvador Gen. Man.: Carlos P. Horta	2 D.H. Heron 3 Beechcraft Bonanza *On order:* 2 D.H. Heron for delivery in 1953	—	600,000	8,300	—	State-subsidised domestic airline.
Viação Aérea Santos Dumont S.A. (V.A.S.D.)	Avenue Franklin Roosevelt 137, Rio de Janeiro Pres.: Luis Tourinho Barreto Man.: Claudio Ricardo Holck	2 Douglas DC-3	1,184	—	—	—	—
Viação Aérea São Paulo S.A. (V.A.S.P.)	Rua Libero Badaró 89, São Paulo Pres.: Prof. Luciano Gualberto Vice-Pres.: Dr. Luiz Augusto de Mattos	14 Douglas DC-3 6 Saab Scandia *On order:* 4 Saab Scandia for delivery in 1953 10 Nord 2501 Noratlas for delivery by December, 1954	5,109	3,300,593	222,048	Freight: 4,918,000 lb. Mail: 68,000 lb.	State of São Paulo holds a 51% interest.
BRITISH CENTRAL AFRICA							
Central African Airways Corporation	Salisbury Airport, P.O. Box 1979, Salisbury, Southern Rhodesia Chairman: Col. Sir Ellis Robins Gen. Man.: P. J. V. Wimbush Ops. Man.: R. A. Bourlay	9 Vickers Viking 6 D.H. Beaver	8,035	3,410,009	94,216	Freight: 1,547,112 lb. Mail: 777,575 lb.	Owned jointly by the Governments of Southern Rhodesia(50%), Northern Rhodesia (35%) and Nyasaland (15%).
BRITISH EAST AFRICA							
Caspar Air Charters and Agencies Ltd.	P.O. Box 2238, 25, Stanley House, Hardinge Street, Nairobi, Kenya Chairman: F.A.White	D.H. Rapides	—	—	—	—	Operates a scheduled service round Lake Victoria from Entebbe, Uganda, in association with East African Airways.
East African Airways Corporation	Sadler House, Sadler Street, Nairobi, Kenya Gen. Man.: Capt. M. Sorsbie	9 Douglas DC-3 2 D.H. Rapide 3 Macchi M.B.320	8,477	2,427,227	65,255	Freight: 1,822,536 lb. Mail: 420,189 lb.	Fleet as at March 1, 1953
BRITISH GUIANA							
British Guiana Airways Ltd.	32, Main Street Georgetown Owner and Man. Dir: Lt.-Col. A. J. Williams	3 Douglas DC-3 3 Grumman Goose 1 Ireland flying-boat	2,100	—	—	—	John H. Hunter & Son, Inc. of 39, Pearl Street, New York 4, N.Y. are Co-owners.
BRITISH WEST AFRICA							
West African Airways Corporation	Lagos Airport, Ikeja, Nigeria Gen. Man.: E. P. Hessey	5 Bristol Freighter 10 D.H. Dove 4 H.P. Marathon	8,677	2,196,215	42,769	229,015 ton-miles	Owned jointly by the Governments of Nigeria (68%), Gold Coast (29½%) Sierra Leone (2%) and Gambia (½%).
BRITISH WEST INDIES							
Bahamas Airways Ltd.	P.O. Box 65, Nassau, Bahamas Chairman: The Hon. H. G. Christie Pres.: Sir Miles Thomas Man. Dir.: W. D. C. Erskine Crum	4 Grumman Goose 1 Grumman Widgeon	984	—	—	—	A subsidiary of B.O.A.C.
British West Indian Airways Ltd. (B.W.I.A.)	Airways House, Chacon Street, Port of Spain, Trinidad Gen. Man.: John Rahr Ops. Man.: P. Wood	6 Vickers Viking 3 Douglas DC-3 *On order:* 3 Vickers Viscount for delivery in early 1955	6,540	1,770,300	60,354	Freight: 376,000 lb. Mail: 104,000 lb.	A wholly-owned subsidiary of B.O.A.C.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
BULGARIA							
Bulgarski Vzdusszni Linii (TABSO) Bulgarian-Soviet Airlines	12, Place Narodno Sabranie, Sofia	11 Li-2 Li-2	570	—			
BURMA							
Union of Burma Airways (U.B.A.)	104, Strand Road, Rangoon Acting Chairman and Gen. Man.: U. Taw	10 Douglas DC-3 3 Handley Page Marathon 5 D.H. Dove 1 Airspeed Consul 1 Auster	4,308				Controlled by a Government Board.
CANADA							
Arctic Wings Ltd.	Churchill, Manitoba Pres.: George Jacobsen	1 Avro Anson 2 Noorduyn Norseman 1 Aeronca Champion					Operates scheduled services in the Hudson Bay area.
Canadian Pacific Air Lines Ltd. (C.P.A.L.)	Vancouver AMF, B.C. Pres.: G. W. G. McConachie Vice Pres.: R. W. Ryan Ops. Dir.: Barney Rawson	3 Douglas DC-6B 4 Douglas DC-4 5 Convair 240 15 Douglas DC-3 2 PBY-5A Canso amph. 2 Avro Anson 2 Noorduyn Norseman *On order:* 1 D.H. Comet Series 1A 2 Douglas DC-6A 1 Douglas DC-6B	24,820	8,823,572	206,722	8,090,451 lb.	Wholly-owned subsidiary of Canadian Pacific Railway. Fleet as at May 1, 1953.
Central Northern Airways Ltd.	Winnipeg Airport, St. James, Man. Pres.: G. H. Sellers Gen. Man.: M. E. Ashton Ops. Man.: F. R. Brown	3 Avro Anson 1 Lockheed Hudson 11 Noorduyn Norseman 7 Single-engine aircraft	3,942	1,004,404	15,325	Freight: 4,375,605 lb. Mail: 382,162 lb.	Aircraft Services (Western) Ltd. is a wholly-owned subsidiary. Fleet as at March 6, 1953.
Leavens Bros. Air Services Ltd.	Barker Airport, Toronto, Ont. Gen. Man.: C. R. Leavens Ops. Man.: W. T. Leavens	5 Cessna T-50	50	46,950	2,452	170,268 lb.	
Maritime Central Airways Ltd.	Charlottetown, P. E. Island Pres.: J. K. Curran Vice-Pres.: F. T. Briggs Gen. Man.: C. F. Burke	9 Douglas DC-3 3 PBY-5A Canso amph. 1 Bristol Freighter Mk. 31 3 Lockheed Electra 2 Avro Anson Mk. 5 1 D.H. Beaver	584	10,000,000	62,000	N.A.	Fleet as at April, 1953.
Mont Laurier Aviation Co., Ltd.	Saint Jean de Brebeuf, Roberval County, P.Q. Pres.: Henri Sabourin Vice-Pres.: Dr. Elzear Hamel Gen. Man.: T. Coughlan	1 Canso amph. 3 Noorduyn Norseman 1 D.H. Fox Moth					Operates a scheduled service between Roberval and Dore Lake.
Quebecair, Inc.	Rimouski, Quebec Pres.: Albert Dionne Gen. Man.: J. H. Lymburner Ops. Man.: M. G. Beaudoin	5 Douglas DC-3 1 Beechcraft D18-A 1 Cessna T-50 3 D.H. Beaver	500	—			Formerly Rimouski Airlines Ltd.
Queen Charlotte Airlines Ltd.	Vancouver A.M.F., B.C. Pres. and Gen. Man.: A. J. Spilsbury Ops. Man.: E. Bendall	2 Canso amph. 1 Douglas DC-3 4 Noorduyn Norseman	1,414	1,609,071	66,073	Freight: 590,302 lb. Mail: 150,505 lb.	Fleet as at March, 1953.
Saskatchewan Government Airways	P.O. Box 850, Prince Albert, Saskatchewan Chairman: W. Housenan Gen. Man.: Ian MacLeod Ops. Man.: F. R. Bau Dais	1 Canso amph. 4 Avro Anson 5 Noorduyn Norseman 3 D.H. Beaver 3 Stinson 4 Cessna 140					Operates services throughout Northern Sask.
Trans-Canada Air Lines (T.C.A.)	International Aviation Building, Montreal Pres.: G. R. McGregor Vice-Pres., Traffic: W. G. Wood Vice-Pres., Ops.: W. F. English	23 Canadair DC-4M2 North Star 27 Douglas DC-3 *On order:* 3 Bristol Freighter	18,915	28,600,919	1,132,518	77,497,093 lb.	T.C.A. is an autonomous Government-owned corporation.
Wheeler Air Lines Ltd.	St. Jovite, Quebec Pres. and Gen. Man.: F. H. Wheeler	1 Canso amph. 1 Avro Anson Mk. 5 3 Noorduyn Norseman 1 D.H. Beaver 1 Cessna 195					Operates a daily scheduled service Montreal - St. Jovite.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
CEYLON							
Air Ceylon Ltd.	P.O. Box 692, 3, Lotus Road, Fort, Colombo 1 Chairman : I. N. Holyman Gen. Man. : W. W. Doyle Traffic Man. : E. R. Knight	2 Douglas DC-4 2 Douglas DC-3	11,971	1,400,975	33,555	—	Operated jointly as a Corporation by Australian Nat. Airways which holds 49% interest and Ceylon Government which holds remaining 51%. International services will cease after September 30, 1953.
CHILE							
Linea Aérea Nacional de Chile (L.A.N.)	Los Cerrillos Airport, Santiago Exec. Vice-Pres. : Arturo Merino Benitez Ops. Man. : Alfonso Cuadrado	4 Martin 202 8 Douglas DC-3 4 Lockheed Lodestar 2 Lockheed Electra 12 D.H. Dove 2 Beechcraft Bonanza *On order :* 6 Douglas DC-3 3 Douglas DC-6B for delivery in 1955	4,002	3,348,430	106,035	—	Government owned.
Linea Aerea del Pacifico Sur Ltda. (L.I.P.A.)	Calle Augustinas 1118, Santiago Pres. : Julio Menendez Gen. Man. : Juan L. Munoz	3 D.H. Rapide 1 Republic Seabee	707	—	—	—	—
CHINA (Communist)							
Sino-Soviet Aviation Corporation (Hamiata)	Tihwa, Sinkiang	*Li-2	1,582	—	—	—	Jointly owned by China and the Soviet Union each with a 50% interest. *Russian-built Douglas DC-3.
Skoga	Peiping	—	—	—	—	—	Operates a service between Peiping and Moscow in association with Aeroflot.
CHINA (Nationalist)							
Civil Air Transport (C.A.T.)	46, Chung Shan Road North, Taipei, Formosa Chairman : Gen. C. L. Chennault Pres. : Whiting Willauer Exec. Vice-Pres. : J. J. Brennan	1 Douglas DC-4 6 Douglas DC-3 23 Curtiss Commando 2 Convair Catalina *On order :* 1 Douglas DC-4 for delivery in 1953	5,700	1,175,015	60,233	Freight : 4,918,000 lb. Mail : 280,000 lb.	Fleet as at June, 1953.
Foshing Airlines	30, Shinn Yang Street, Taipei, Formosa Chairman : Moon F. Chin Gen. Man. : Ango Tai	3 Convair Catalina amph. 1 Curtiss Commando	770	—	—	—	—
COLOMBIA							
Aerovias Nacionales de Colombia (AVIANCA)	Carrera 7a., No. 16-14, Bogotá Pres. : Gregorio A. Obregón Dir. Ops. : Rafael Barvo	2 Lockheed Constellation L-749A 8 Douglas DC-4 25 Douglas DC-3 5 Curtiss Commando 1 Convair Catalina amph. *On order :* 3 Lockheed Super Constellation L-1049C for delivery in 1954	27,844	11,231,628	614,574	Freight : 144,756,870 lb. Mail : 989,564 lb.	Lansa Consolidada is a wholly-owned subsidiary.
Lineas Aéreas Nacionales Consolidadas S.A. (L.A.N.S.A.)	Calle 34, No. 40-53, Barranquilla Chairman : Enrique A. de la Rosa Gen. Man. : Sabas Pretelt M.	16 Douglas DC-3	5,145	7,560,000 traffic ton-miles	235,036	Freight : 25,546,000 lb. Mail : 3,038,000 lb.	A wholly-owned, but independent, domestic subsidiary of Avianca.
Sociedad Aérea del Tolima S.A. (SAETA)	Calle 19, No. 6-39—6-41, Bogotá Chairman : Guillermo Molano G. Pres. and Gen. Man. : Jaime Reyes-Patria Chief Ops. : Raul Garavito D.	5 Douglas DC-3	1,760	—	—	—	Avianca holds a 30% interest in SAETA.
Sociedad Aeronautica Medellin S.A. (S.A.M.)	Avenida 1o de Mayo 49-100, Apartado Aereo 1085, Medellin Chairman : Dennis C. Powelson Gen. Man. : Pedro A. Mena V. Ops. Man. : John F. Reilly and Aurelio Jimenez	5 Curtiss Commando 3 Douglas DC-3	5,947	—	—	—	Operates scheduled freight services only.
Uraba, Medellin & Central Airways, Inc. (U.M.C.A.)	320, Caraboba, Medellin Pres. : Erwin Balluder Vice-Pres. : R. A. Lord	Douglas DC-3	590	—	—	—	P.A.W.A. holds a substantial interest in the Company.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
COSTA RICA							
Lineas Aéreas Costarricenses S.A. (LACSA)	Avenida la. No. 39 E., Apartado 1531, San José Gen. Man.: Robert E. Smith Ops. Man.: Jorge Paris	4 Curtiss Commando 4 Douglas DC-3	3,539*	1,283,373	91,856	12,834,000 lb.	An affiliate of Pan American World Airways which holds 40% of the stock, the remainder being held by the Costarrican Government (20%) and Costarrican citizens (40%). *As at March, 1953.
CUBA							
Aerovias "Q" S.A.	Cienfuegos 70, Havana Pres.: Manuel Quevedo, Jr. Vice-Pres.: Angel Aixalá Vice-Pres., Ops.: J. E. Alvarez Regato	5 Douglas DC-3 3 Budd Conestoga	490	489,328	73,222	Freight: 3,849,480 lb. Mail: 140,673 lb.	Fleet as at March 17, 1953.
Compania Cubana de Aviacion S.A. (Cubana)	Calle 23 No. 105, Vedado, Havana Pres. and Gen. Man.: Sergio I. Clark	2 Douglas DC-4 6 Douglas DC-3	7,970	4,055,069	238,055	456,588 ton-miles	Pan American World Airways holds a 20% interest. Fleet as at March 1, 1953.
Cuba Aeropostal S.A. (CASA)	Apartado Postal 302, Havana Pres.: Gustavo E. Alfonso Vice-Pres.: Manuel H. Jimenez Chief, Ops.: Antonio Soto	4 Curtiss Commando 1 Douglas DC-3					
Expreso Aereo Inter-Americano S.A. (Expreso)	Prado 50, Havana Pres.: Miguel Varona Guerrero Gen. Man.: Jose A. Galdo Ops Man.: R. Trusillo	3 Curtiss Commando	325	—			Official airmail carrier.
CYPRUS							
Cyprus Airways Ltd.	18, Homer Avenue, Nicosia Man. Dir.: J. A. Vick	6 Douglas DC-3	7,000	1,124,950	26,724	1,133,440 lb.	Jointly owned by B.E.A. 23%; B. O. A. C. 23%; Cyprus Government 31% and Cypriot citizens 23%.
CZECHOSLOVAKIA							
Ceskoslovenské Aerolinie, n.p. (C.S.A.)	Nam Republiky Palace Kotva, Prague I Dir.-Gen.: Leopold Thurner Ops. Man.: Major J. Hubacek	7 Ilyushin IL-12 30 Douglas DC-3	6,388	—			
DENMARK							
Det Danske Luftfartselskab A S (D.D.L.)	Kastrup Airport, Copenhagen Chairman of Board: Per Kampmann Pres.: K. Lybye						A non-operative holding company in the S.A.S. consortium. See under "Scandinavia."
DOMINICAN REPUBLIC							
Compania Dominicana de Aviacion S.A.	Ciudad Trujillo Pres.: General Frederico Fiallo Vice-Pres.: George M. Burrie	4 Curtiss Commando 2 Douglas DC-3 1 Beechcraft D18 1 D.H. Beaver	1,686	—			P.A.W.A. holds a 40% interest in the Company.
ECUADOR							
Aerovias Ecuatorianas C.A.	661, Calle Garcia Moreno, Quito Pres.: Luis Arias Vice-Pres. and Ops Man.: Agustin Arias Gen. Man.: Juan Escobar	2 Boeing Stratoliner 4 Douglas DC-3 3 Ryan Navion	3,533	1,156,880 traffic ton-miles	58,049	Freight: 7,942,000 lb. Mail: 1,014,000 lb.	Sole scheduled operator in Ecuador.
EGYPT							
Misrair S.A.E.	Almaza Airport Heliopolis Chairman: Abdel Maksud Ahmed Dep. Gen. Man.: Gamal El Din Kotby	4 Languedoc 161 7 Vickers Viking 1B 1 Beechcraft 18 1 Beechcraft Bonanza 1 Miles Gemini	11,822	2,123,901	76,788	1,898,009 lb.	
EL SALVADOR							
TACA International Airlines S.A.	San Salvador Pres.: Ricardo H. Kriete Exec. Vice-Pres.: G. R. Woody Vice-Pres. Ops.: Charles H. Strickland	3 Douglas DC-4 2 Douglas DC-3	2,566	—			Only remaining operating subsidiary of the TACA Corporation, Alabama, U.S.A.
ETHIOPIA							
Ethiopian Airlines Inc.	P.O. Box 1755, Addis Ababa Pres.: H. E. Lij Yilma Deresso Gen. Man.: W. G. Golien	*2 Convair 240 7 Douglas DC-3	8,370*	1,632,653	40,806	7,470,290 lb.	*As at April 1, 1953.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
FIJI ISLANDS							
Fiji Airways	Nousori Airport, Suva Man. Dir. and Gen. Man.: Hon. Harold Gatty	2 D.H. Rapide *On order:* 3 D.H. Drover	210	—	—	—	Fleet as at April, 1952.
FINLAND							
Aero Osakeyhtio (Aero O/Y-Finnish Airlines)	Mannerheimintie 9b, Helsinki Pres.: S. J. Ahola Vice-Pres.: E. Harma Man. Dir.: General Leon. Grandell	9 Douglas DC-3 1 Convair 340 *On order:* 2 Convair 340 for delivery in 1953	3,256 (3,882)*	2,013,047	107,263	Freight: 686,004 lb. Mail: 539,475 lb.	Finnish Government hold a 73% interest, remainder being held by Finnish banking and shipping interests. *During Summer season.
Savon Lewtolinjat O/Y.	Helsinki	2 D.H. Dragon	125	—	—	—	Operates a daily scheduled service during the summer period between Helsinki and Mikkelin.
Veljekset Karhumaki O/Y. (Karhumaki Airways)	Kuorevesi Chief Man.: Niilo Karhumäki Asst. Man.: Valto Karhumäki	Lockheed Lodestars	625	—	—	—	Operates scheduled services locally and to Sweden.
FRANCE							
Air Sud	Montpellier	3 Lockheed Lodestar	1,242	—	—	—	—
Société Aigle Azur	Avenue des Champs Elysées 70, Paris 8e Pres.: Sylvain Floriat	5 Boeing Stratoliner 12 Douglas DC-3 6 D.H. Rapide 3 Airspeed Consul	18,440	2,108,295	22,563	Freight: 649,000 lb.	—
Société de Transports Aériens Alpes-Provence	Rue Fortia 10, Marseilles Pres.: M. A. Freton Dir.: M. F. Audoli	8 Douglas DC-3	7,210	—	—	—	Société des Transport Aériens Camerounais is an associate company formed in October, 1950. Alpes Provence Méditerranée is an associate company formed in January, 1951.
Compagnie Nationale Air France (Air France)	Rue Marbeuf 2, Paris 8e Chairman: Max Hymans Gen. Man.: Henri Ziegler Ops. Man.: Jacques Scherer	2 D.H. Comet Series 1A 2 Breguet 76-3 Deux Ponts 23 Lockheed Constellation L-749A 24 Douglas DC-4 20 SE 161 Languedoc 38 Douglas DC-3 12 Junkers Ju. 52 10 Caudron Goeland *On order:* 10 Lockheed Super Constellation L-1049C delivery in 1953. 1 D.H. Comet Series 1A for delivery in July, 1953. 10 Breguet 76-3 Deux Ponts for delivery in 1953-55. 12 Vickers Viscount 708 for delivery in 1953-55. 1 Douglas DC-3	153,000	33,665,652	1,056,230	Freight: 81,118,400 lb. Mail: 18,282,000 lb.	Fleet as at June 30, 1953.
Compagnie de Transports Aériens Intercontinentaux (T.A.I.)	Rue de l'Amiral d'Estaing 23, Paris 16e Dir. Gen.: General Georges Fayet Man. Dir.: A. Gaffié Vice-Pres., Ops.: Claude Gouin	2 Douglas DC-6B 4 SE 2010 Armagnac 3 Douglas DC-4 *On order:* 1 Douglas DC-6B for delivery in 1953	30,367	3,287,128	24,747	2,312,544 lb.	—
Union Aéromaritime de Transport (U.A.T.)	Boulevard Malesherbes 19, Paris 8e Gen. Man.: Z. Vidal	3 D.H. Comet Series I 4 Douglas DC-4 3 Douglas DC-3 3 D.H. Heron *On order:* 3 D.H. Heron	27,640*	3,223,427	31,684	Freight: 8,800,940 lb. Mail: 299,227 lb.	*As at July, 1952.
FRENCH GUIANA							
Société Aérienne des Transports Guyane-Antilles	Cayenne, French Guiana	3 SCAN 30 amph. (Grumman Widgeon licence)	—	—	—	—	Operates local services in French Guiana with aircraft loaned by the French Government.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
FRENCH INDO-CHINA							
Air Laos	Vientiane, Laos	Douglas DC-3	-				Began operations, Dec. 15, 1952. Owned by 50 50 Laos French interests. Of French-owned stock 20% belongs to Air France and 30% to Aigle-Azur, the latter supplying equipment and operating personnel.
Air Outre-Mer	53, avenue des Etats-Unis, Hanoi Man. Dir.: Roger Colin	6 Douglas DC-3	—		13,500	Freight: 15,373,260 lb.	Formerly Compagnie Aérienne de Transports Indochinois.
Air Vietnam	Boulevard Bonard 123, Saigon Pres.: Nghiem van Tri Man. Dir.: Ly Cong Trinh Ops. Man.: Schlegel	†3 Douglas DC-4 4 Douglas DC-3 3 Bristol 170	13,640*	2,768,912	131,109	Freight: 18,289,930 lb. Mail: 1,757,094 lb.	The Vietnamese Government holds a 50% interest, the other 50% being held partly by Air France and local companies. †Chartered from Air France. Remaining aircraft are variously provided by S.I.T.A. and the Vietnamese Government or, owned by the Company. *As at July, 1952.
Compagnie Autrex	Boulevard Gia-Long 25, Hanoi	1 Douglas DC-3 1 Junkers Ju. 52 2 D.H. Rapide	—				
Société de Transports Aériens en Extrême-Orient (S.T.A.E.O.)	Rue Turc 5-13, Saigon Man. Dir.: Pham Hoe Dir. Gen.: Maurice Loubiere	5 Douglas DC-3 2 SO-30P Brétagne	2,263	788,000	53,391	6,546,000 lb.†	Fleet as at April 27, 1953. †Freight only.
FRENCH MOROCCO							
Compagnie Chérifienne de l'Air (Air Atlas)	167, avenue Poeymirau, Casablanca Dir. Gen.: Gustave Chabbert Ops. Man.: H. Seguier	†3 Languedoc 161 6 Douglas DC-3 *On order:* 1 Douglas DC-4 for delivery in 1953	2,000	1,491,705	64,148	Freight: 3,316,789 lb. Mail: 389,641 lb.	Jointly owned by the Moroccan Government, Air France and various private firms. †Operated in pool with Air France. Now merged with Air Maroc to form a new company operating under the latter's name.
Compagnie Chérifienne de Transports Aériens (C.C.T.A.) Air Maroc	Rue du Quatre Septembre 35, Paris Pres. and Dir. Gen.: General Corniglion Molinier Dep. Dir.-Gen.: M. Chabbert	*11 various	N.A.	2,955,928	83,486	Freight: 2,626,800 lb. Mail: 426,800 lb.	Formed by the merger of Air Maroc and Air Atlas. *Types of aircraft comprising combined fleet unknown, but include Douglas DC-4. Ownership is divided equally between Air France, the Moroccan Government, the Paquet and Fraissinet Shipping Group, Cie. Generale Trans-atlantique and Cie. Air Transport.
Compagnie Chérifienne du Pont Aérien	Casablanca Man. Dir.: Francois Idrac	*2 Bristol Type 170 Mk. 31E					Started a car ferry service between Morocco and Spain on June 1, 1953. *Chartered from Aviación y Comercio S.A. (Aviaco), Madrid.
Société Avia Maroc Ligne Aérienne (Air Maroc)	Avenue de la Republique 5, Casablanca Pres.: General Cornighon Molinier Ops. Man.: M. Michy	6 S.O. 30P Bretagne 4 Curtiss Commando *On order:* 6 Convair 340	6,600	1,353,000 traffic ton-miles	N.A.	N.A.	Air Maroc has been merged with Air Atlas to form a new company which retains the name of the former.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
FRENCH TUNISIA							
Société Tunisienne de l'Air (Tunis Air)	Rue d'Athenes 1, Tunis Dir. Gen.: Rene Lefevre	1 Languedoc 161 4 Douglas DC-3	3,921				Air France holds 35% of capital, the Tunisian Government 35%.
GIBRALTAR							
Gibraltar Airways Ltd.	Cloister Building, Box 212, Irish Town Chairman: Sir George Gaggero	3 D.H. Rapide	90	124,344	13,085	47,264 lb.	B.E.A. holds a 51% interest, the remaining 49% being held by a Gibraltar shipping company, M. H. Bland & Co., Ltd.
GREAT BRITAIN							
Air Kruise Ltd. (Trans Channel Airways)	Lympne Airport, Nr. Hythe, Kent Chairman and Man. Dir.: H. C. Kennard Ops. Man.: W. T. Mellor	6 D.H. Rapide *On order:* 2 D.H. Heron for delivery in 1953	133*	150,000	12,000	Nil	Air Kruise (Kent) Ltd. is a subsidiary company. Operates scheduled services in association with B.E.A. Fleet as at June, 1953.
Airlines (Jersey) Ltd. (Jersey Airlines)	4, The Parade, St. Helier, Jersey, C.I. Man. Dir.: M. L. Thomas Gen. Man.: D. Le Calvez	1 D.H. Heron 6 D.H. Rapide *On order:* 1 D.H. Heron for delivery in 1953	1,120	500,000	25,000	Nil	Fleet as at May 1, 1953
Airwork Ltd.	15, Chesterfield Street, London, W.1. Pres.: T. L. E. B. Guinness Chairman: M. D. N. Wyatt Man. Dir.: Sir Archibald P. Hope, Bt.	7 Vickers Viking	4,520*	90,040*	838*	Freight: 4,659 lb.* Mail: Nil	*June 14.-Dec. 31, 1952, for one (scheduled) route only.
Aquila Airways Ltd.	1, Great Cumberland Place, London, W.1. Chairman: Eoin C. Mekie Man. Dir.: Barry T. Aikman	1 Short Solent 1 Short Hythe *On order:* 2 Short Solent for delivery in 1953	2,400	600,000	7,500	33,075 lb.	Fleet as at April 30, 1953.
Birkett Air Service Ltd.	237, Acton Lane, London, W.4. Man. Dir.: G. Birkett Ops. Man.: Lee Warner	3 D.H. Rapide 1 Percival Proctor Mk. 4	320	51,920	1,376	Nil	Ceased operations Sept. 30, 1952.
B.K.S. Aerocharter Ltd.	Dorset House, Old Burlington Street, London, W.1. Chairman and Man. Dir.: C. J. Stevens	4 Douglas DC-3	1,243	N.A.	N.A.	N.A.	Began scheduled operations in May, 1953.
British European Airways Corporation (B.E.A.)	Keyline House, Ruislip, Middlesex Chairman: Lord Douglas of Kirtleside Chief Executive: P. G. Masefield Ops. Dir.: J. W. G. James	5 Vickers Viscount 701 20 Airspeed Ambassador 41 Vickers Viking 38 Douglas DC-3 (Pionair version) 10 Douglas DC-3 (Pionair/Leopard version) 1 Douglas DC-3 (Dart turboprop version) 15 D.H. Rapide *Helicopter Unit:* 3 Sikorsky S-51 1 Bristol 171 2 Bell 47B *On order:* 21 Vickers Viscount 701 12 Vickers Viscount 800	16,158	25,104,903	1,368,333	Freight: 31,275,400 lb. Mail: 12,867,600 lb.	
British Overseas Airways Corporation (B.O.A.C.)	Airways House, Great West Road, Brentford, Middlesex Chairman: Sir Miles Thomas Ops. Dir.: Sir Victor Tait	7 D.H. Comet Series 1a 22 Canadair Argonaut 10 Boeing Stratocruiser 5 Lockheed Constellation L-749 7 Lockheed Constellation L-049 19 Handley Page Hermes 4 7 Avro York Freighter *On order:* 12 D.H. Comet Series 2 for delivery in 1953-4 26 Bristol 175 Britannia for delivery in 1954-5	89,654	35,793,210	295,542	18,706,400 lb.	Fleet as at June 30, 1953.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
GREAT BRIT. *cont.* **Cambrian Air Services Ltd.**	Cardiff Airport, Glam., South Wales Chairman: J. H. Watts Joint Man. Dirs.: L. B. Elwin, W. W. Stanley Traffic Man.: B. J. T. Callan	3 D.H. Dove 7 D.H. Rapide 2 Percival Proctor 1 Auster	1,560*	480,000	8,500	Nil	*As at June 1, 1953.
Don Everall (Aviation) Ltd.	Elmdon Airport, Birmingham Chairman: D. Everall Ops. Man.: A. D. Atkinson	3 D.H. Rapide 1 Miles Messenger 1 Auster *On order:* 1 D.H. Rapide for delivery in 1953	1,000*	75,000	1,087	Nil	*As at May 1, 1953.
Eagle Aviation Ltd.	29, Clarges Street, London, W.1. Man. Dir.: H. Bamberg Ops. Man.: W. Hodgson Traffic Man.: G. W. Pitt	5 Vickers Viking Mk. 1B 2 Douglas DC-3	1,090†	N.A.	N.A.	N.A.	†Began scheduled service between London and Belgrade, June 6, 1953. Numerous other services are under negotiation. Fleet as at June 30, 1953.
East Anglian Flying Services Ltd. (Channel Airways)	Southend Airport, Southend-on-Sea, Essex Chairman and Man. Dir.: R. T. Jones Traffic Man.: D. Burgess	4 D.H. Rapide	1,500*	110,000	2,400	Nil	*As at June 1, 1953. Operates scheduled services in association with B.E.A.
Hunting Air Transport Ltd.	5, Fitzhardinge Street, Portman Square, London, W.1. Man. Dir.: M. H. Curtiss Tech. Man.: L. B. Greensted Traffic Man.: R. J. Wingrave	8 Vickers Viking 4 Douglas DC-3 *On order:* 3 Vickers Viscount 732 for delivery in 1955	14,942	2,193,749	40,532	—	A Hunting Group Company. Has authority to operate 9 scheduled routes to points in Europe and a service to Nairobi.
Lancashire Aircraft Corporation Ltd.	7, Berkeley Street, London, W.1. Chairman: David Brown Man. Dir.: Eric Rylands Ops. Man.: H. P. Snelling	3 Douglas DC-3 1 D.H. 86 4 D.H. Rapide	684	222,690	13,483	Freight: 40,940 lb. Mail: Nil	Fleet as at May 31, 1953. Skyways Ltd. is a wholly-owned subsidiary.
Manx Airlines Ltd.	Ronaldsway Airport, Ballasalla, Isle of Man. Chairman: G. H. Drummond Man. Dir.: G. S. Hankinson Traffic Man.: T. Kavanagh	2 Douglas DC-3 4 D.H. Rapide	350	266,700	11,600	Nil	Fleet as at June 10, 1953.
Morton Air Services Ltd.	Croydon Airport, Surrey Man. Dir.: T. W. Morton Traffic Man.: P. L. Eskell	4 D.H. Dove 3 D.H. Rapide 3 Airspeed Consul	N.A.	126,000	8,500	Nil	Fleet as at June 1, 1953.
Murray Chown Aviation Ltd.	Staverton Airfield, Cheltenham, Glos. Chairman: C. M. Chown	1 D.H. Rapide	Operates * to Channel Isles	—	—	—	*Scheduled passenger service only.
Olley Air Service Ltd.	Croydon Airport, Surrey. Chairman: T. W. Morton Man. Dir.: G. P. Olley	4 D.H. Dove 3 D.H. Rapide 3 Airspeed Consul	500	30,240	1,344	Nil	A wholly-owned subsidiary of Morton Air Services Ltd. Fleet as at June 8, 1953.
Scottish Aviation Ltd. (Scottish Airlines)	Prestwick Airport, Ayrshire Chairman: D. F. McIntyre Gen. Man.: J. A. Dobson	3 Douglas DC-3 2 D.H. Rapide	850	287,985	28,331	68,000 lb.	—
Silver City Airways Ltd.	1, Great Cumberland Place, London, W.1. Chairman: Eoin C. Mekie Man. Dir.: Air Commodore G. J. Powell, C.B.E. Ops. Man.: A. B. Lamplugh	8 Bristol Freighter Mk. 21 1 Airspeed Consul 1 D.H. Dragonfly *On order:* 6 Bristol Freighter Mk. 32 for delivery in 1953	218*	298,585	27,270	(1) Cars: 6,865 (2) Motor cycles: 2,203 (3) Pedal cycles: 1,842 (4) Freight: 2,480,000 lb.	Operates vehicle ferry and freight services to the Continent. The Company is a subsidiary of Britavia Ltd. Aquila Airways Ltd. is an associated company. *As at December 31, 1952.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
GREAT BRIT.—*cont.*							
Starways Ltd.	Liverpool Airport, Speke, Liverpool 19 Chairman: F. H. Wilson Traffic Man.: J. M. Kent	2 Douglas DC-3 2 Avro Anson 1 D.H. Rapide	89	220,000*	4,800*	Nil	*Inclusive of all operations for the year 1952.
Transair Ltd.	Croydon Airport, Croydon, Surrey Man. Dir.: Gerald H. Freeman Ops. Dir.: C. Nunn Traffic Man.: H. S. Perren	3 Douglas DC-3 8 Avro Anson 3 Airspeed Consul 1 Percival Proctor	Operates service to Channel Isles	—	—	—	Fleet as at March 6, 1953.
GREECE							
National Greek Airlines (T.A.E.)	12, Merlin Street, Athens Chairman: C. Iliaskos Man. Dir.: General George Reppas Ops. Man.: P. Razelos	1 Douglas DC-4 16 Douglas DC-3 1 Fairchild	8,864	3,069,384	176,960	Freight: 11,001,712 lb. Mail: 573,110 lb.	The Greek Government holds a 10% interest and T.W.A. a 15% interest. T.A.E. re-started operations in May, 1953, after a period of inactivity due to financial reorganisation.
GUATEMALA							
Empresa Guatemalteca de Aviacion (Aviateca)	Guatemala City Pres.: Ricardo Rodriguez P	7 Douglas DC-3 1 Curtiss Commando	3,140	1,050,000	79,000	10,840,000 lb.	State-owned. Fleet as at March 1, 1953.
HAITI							
Corps d'Aviation de l'Armée d'Haiti	Bowen Field, Port-au-Prince Comm.: Lt.-Col. G. Edouard Roy	3 Douglas DC-3 1 Beechcraft D18	784	N.A.	N.A.	N.A.	Fleet as at May 2, 1953.
HAWAIIAN ISLANDS							
Hawaiian Airlines, Ltd.	Inter-Island Building, Honolulu 1 Pres.: Stanley C. Kennedy Vice-Pres., Ops.: Ford Studebaker	2 Convair 340 13 Douglas DC-3 *On order:* 4 Convair 340 for delivery in 1953	402	3,803,384	363,541	17,821,794 lb.	—
Trans-Pacific Airlines, Ltd. (The Aloha Airline)	P.O. Box 2113, Honolulu, T.H. Pres.: Ruddy F. Tongg Exec. Vice-Pres.: David A. Benz Ops. Man.: Olen V. Andrew	5 Douglas DC-3	1,007	19,691,714 rev. pass. miles	152,826	90,377 ton-miles	*As at March, 1953.
HONDURAS							
Servicio Aereo de Honduras S.A. (SAHSA)	Avenida Colon y Cuarta Calle, Tegucigalpa Pres.: Carlos Izaguirre Vice-Pres.: Horacio Moya Posas Ops. Man.: Edward C. Brice	4 Douglas DC-3	1,266	—	—	—	Pan American World Airways holds a 40% interest.
Transportes Aereos Centro-Americanos S.A.	Tegucigalpa Pres.: Augusto Rodriguez Vice-Pres.: Jesse A. Jett	8 Douglas DC-3	1,060	—	—	—	Formerly TACA de Honduras, now a National company.
Transportes Aereos Nacionales S.A. (T.A.N.)	Edificio Marichal, Tegucigalpa, D.C. Pres.: Miguel Brooks Vice-Pres.: Robert C. Forsblade Gen. Man.: Miguel Brooks L.	1 Curtiss Commando	1,180	—	—		
HONGKONG							
Cathay Pacific Airways, Ltd.	1, Connaught Road, Central, Hong Kong Chairman: J. A. Blackwood Man. Dir.: W. C. G. Knowles	1 Douglas DC-4 2 Douglas DC-3	6,759	985,639	15,206	1,322,655 lb.	—
Hong Kong Airways Ltd.	18, Pedder Street, Hong Kong Chairman: John Keswick Man.: M. J. C. Auster	1 Douglas DC-4	550	193,600	5,070	503,360 lb.	Formerly a wholly owned affiliate of B.O.A.C. until purchased by Jardine, Matheson & Co., Ltd. Now operated by the present owners as a private company with routes to Formosa using chartered aircraft.
HUNGARY							
Magyar-Szovjet Legiforgalmi Reszveny Tarsasag (Maszoviet)	Dorottya Utca 7, Budapest Pres.: Josef Szintai	10 Li-2 (Russian-built Douglas DC-3)	1,848	—	—	—	Hungary and Russia each hold a 50% interest.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
ICELAND							
Flugfelag Islands H.F. (Iceland Airways)	Reykjavik Airport, Reykjavik Chairman: Gudmundur Vilhjalmsson Gen. Man.: Orn O. Johnson	1 Douglas DC-4 3 Douglas DC-3 3 Convair Catalina 1 Grumamn Goose 1 D.H. Rapide 1 Noorduyn Norseman	6,660	852,952	37,970	Freight: 1,682,666 lb. Mail: 158,021 lb.	Fleet as at May 1, 1953.
Loftledir H.F. (Icelandic Airlines	Lackjargata 2, Reykjavik Gen. Man.: Gunnar Gunnarsson	1 Douglas DC-4	5,570	263,304	2,599	Freight: 243,458 lb. Mail: 26,316 lb.	
INDIA							
Air India Ltd.	New India Insurance Building, Mahatma Gandhi Road, Bombay 1 Chairman: J. R. D. Tata Gen. Man.: K. C. Bakhle Ops. Man.: A. C. Gazdar	1 Douglas DC-4 10 Douglas DC-3 7 Vickers Viking	4,220	3,865,000	92,240	Freight: 4,401,000 lb. Mail: 1,975,000 lb.	
Air India International Ltd.	New India Assurance Building, Mahatma Gandhi Road, Bombay 1 Chairman: J. R. D. Tata Man. Dir.: K. C. Bakhle	4 Lockheed Constellation 749A *On order:* 2 Lockheed Super Constellation 1049C for delivery in 1953 2 D.H. Comet Series 3 for delivery in 1957	19,300	2,697,000	21,499	Freight: 1,169,000 lb. Mail: 482,000 lb.	
Air Services of India Ltd.	Scindia House, Dougal Road, Ballard Estate, Bombay 1 Man. Dir.: Shri N. Dandeker	8 Douglas DC-3 3 Convair Stinson Sentinel	1,918	857,136	33,455	Freight: 1,954,000 lb. Mail: 182,000 lb.	Fleet as at March 1, 1953.
Airways (India) Ltd. (A.I.L.)	15, Ganesh Chandra Avenue, Calcutta 13 Chairman: N. D. Agarwalla Man. Dir.: K. K. Roy	17 Douglas DC-3 2 D.H. Dove	4,251	4,604,828	108,146	Freight: 34,634,466 lb. Mail: 106,134 lb. Newspapers: 957,980 lb.	Holds a 48% interest in Aeronautical Services Ltd.
Bharat Airways Ltd.	4, Chittaranjan Avenue, Calcutta, 17 Chairman: B. M. Birla Gen. Man.: H. R. Sugla	2 Douglas DC-4 10 Douglas DC-3 1 Avro XIX 1 Stinson Sentinel	4,169	2,971,972	78,443	Freight: 36,294,720 lb. Mail: 898,240 lb.	
Deccan Airways Ltd.	Begumpet Airport, Hyderabad, Deccan Chairman: A. V. Pai Man. Dir.: P. M. Reddy	11 Douglas DC-3	3,596	2,839,004	53,162	Freight: 2,854,637 lb. Mail: 3,894,423 lb.	The Government of India holds a controlling interest.
Himalayan Aviation Ltd.	9a, Esplanade East, Calcutta Dir. and Gen. Mgr.: P. K. Ghosh Ops. Man.: J. A. Chitambar	7 Douglas DC-3	3,288				
Indian National Airways Ltd. (I.N.A.)	Malhotra Building, Queensway, New Delhi Chairman: V. H. Dalmia Gen. Man.: J. M. Gupta	6 Vickers Viking 7 Douglas DC-3 1 Beechcraft D18 1 Beechcraft Bonanza	3,339				
Kalinga Air Lines	Suite No. 140, Grand Hotel, Calcutta, 13 Proprietor: B. Patnaik Ops. Man.: A. W. Hebborn	7 Douglas DC-3 1 Convair Catalina amph. 1 Stinson L-5	197				
INDONESIA							
Garuda Indonesian Airways N.V.	Djakarta Man. Dir.: Dr. E. van Konijnenburg Dep. Dirs.: C. A. Mochtar and D. K. van Houten	8 Convair 240 4 Convair Catalina amph. 15 Douglas DC-3 *On order:* 14 D.H. Heron due for delivery in 1953 8 Convair 340 due for delivery in 1953/54	15,308	5,952,285	285,000	23,227,956 lb.	Indonesian Government and K.L.M. both hold a 50% interest.
IRAN							
Iranian Airways Company	Avenue Saadi, Teheran Pres.: Ali Asghar Hekmat Man. Dir.: R. Afshar Dir., Ops.: J. P. Chatelard	5 Douglas DC-3 3 D.H. Dove 2 Fairchild Argus 24W	6,684				
IRAQ							
Iraqi Airways	Iraqi State Railways, Baghdad West Man.: Col. Sabah el Saad	3 Vickers Viking 1 D.H. Dove *On order:* 3 Vickers Viscount	3,330	1,045,000 traffic ton-miles	21,444	- -	Government-owned. Operated as a department of the Iraqi State Railways.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
IRELAND							
Aer Lingus Teoranta	43, Upper O'Connell Street, Dublin Chairman: E. T. McCarron Gen. Man.: J. F. Dempsey Ops. Man.: W. J. Scott	12 Douglas DC-3 4 Bristol Wayfarer Mk. 31E *On order:* 4 Vickers Viscount 707 for delivery in 1954	2,905	3,825,434	293,504	Freight: 7,498,299 lb. Mail: 2,934,504 lb.	Aer Rianta holds 60% interest on behalf of the Irish Government and B.E.A. 40%.
ISRAEL							
EL AL Israel Airlines Ltd.	31, Rothschild Boulevard, Tel-Aviv Man. Dir.: Louis A. Pincus Dep. Man. Dir.: Yoel Palgi	3 Lockheed Constellation 6 Curtiss Commando	15,805	2,242,138	24,776	2,270,400 lb.	State of Israel holds 63% interest and public institutions 37%. Holds a 50% interest in Israel Inland Airlines Ltd. ("ARKIA"). Fleet as at April 1, 1953.
Israel Inland Airlines Ltd. ("ARKIA")	70, Ahad Haam Street, Tel-Aviv Dir. Gen.: Y. Hausman Dir. of Ops.: R. Lurie	2 Curtiss Commando 1 D.H. Rapide 1 Airspeed Consul *On order:* 2 D.H. Rapide for delivery in 1953	336	112,048	19,695	1,247,464 lb.	Operates internal routes in Israel. Fleet as at March, 1953.
ITALY							
Aerolinee Italiane Internazionali (Alitalia)	Via Leonida Bissolati 20, Rome Pres.: Count Dr. Nicolo Carandini Vice-Pres.: Lord Douglas of Kirtleside Man. Dir.: Ing. Luigi Acampora Gen. Man.: Ing. Bruno Velani	4 Douglas DC-4 2 Convair 340 *On order:* 1 Convair 340 for delivery in September, 1953 4 Douglas DC-6B for delivery in 1953-4	19,406		17,692	949,923 lb.	Jointly owned by the Italian Ministry of Finance 66.25%, Italian citizens 3.75% and B.E.A. 30%. Fleet as at June 30, 1953.
Linee Aeree Italiane (L.A.I.)	Via del Tritone 132, Rome Pres.: Prince Don Marcantonio Pacelli Man. Dir.: Gen. Luigi Gallo Ops. Man.: Cdte. Bruno Satti	3 Douglas DC-6B 3 Douglas DC-6 20 Douglas DC-3 4 Convair 240 *On order:* 3 Douglas DC-6B 1 Douglas DC-6 4 Convair 240	14,759†	4,302,977	159,004	Freight: 4,844,407 lb. Mail: 1,178,916 lb.	Trans World Airlines holds a 40% Interest. Fleet as at May 31, 1953. †As at March 31, 1953.
JAPAN							
Nippon Koku K.K. (Japan Air Lines)	New Marunouchi Bldg. 4, 1-chome, Marunouchi, Chiyoda-ku, Tokyo Pres.: Seijiro Yamagita Man. Dir.: Shizuma Matsuo Ops. Man.: Sadao Segawa	6 Douglas DC-4 3 Beechcraft D18 1 Beechcraft AT-11 Kansan *On order:* 1 Douglas DC-6A passenger conversion 2 Douglas DC-6B 3 D.H. Heron 2 D.H. Comet Series 2	1,225*	1,457,132†	120,160†	Freight:† 536,000 lb. Mail: 576,000 lb.	*As at March, 1953. †March 31, 1952-April 30, 1953.
JORDAN							
Air Jordan	Salt Road, P.O. Box 274, Amman Gen. Man.: F. G. Kendall Ops. Man.: J. Waterman	2 Douglas DC-3 2 Curtiss Commando 2 Airspeed Consul	2,221	201,129	4,312	68,018 lb.	Fleet as at May 1, 1953.
Arab Airways Association Ltd.	Station Road, P.O. Box 367, Amman Chairman: M. A. Bdeir Gen. Man.: J. Patient	2 D.H. Rapide 2 Airspeed Consul 1 Chrislea Ace 1 Percival Proctor 1 D.H. Tiger Moth	594				Fleet as at June 8, 1953
KOREA							
Korean National Airlines	No. 8, 2nd KA, Chsong-Ang-Dong, Pusan Pres.: Y. W. Shinn Gen. Man.: John Surk	Douglas DC-3's					Operates three scheduled services from Pusan in association with Civil Air Transport, Inc.
LEBANON							
Air-Liban	Esseyli Building, Assour Square, P.O. Box 1243, Beirut. Gen. Man.: Basile Meguerdiche	1 Languedoc 161 4 Douglas DC-3	4,000	792,396	21,869		Air France holds a 33⅓% interest.
Société des Lignes Aériennes pour le Moyen-Orient S.A. (Middle East Airlines)	Parliament Square, Beirut Pres.: Sa'eb Bey Salaam Gen. Man.: Najib Al Amuddin Ops. Man.: Salim A. Salaam	6 Douglas DC-3	4,516				P.A.W.A. holds a 36% interest.
LIBERIA							
Liberian National Airways	Robertsfield Airport, Terminal, Harbel Pres.: F. H. Syphert	1 Douglas DC-3 1 D.H. Rapide	113				Formerly Liberia International Airways.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
LIBYA							
Libyan Airways	Tripoli Man.: Kenneth Jolly	2 Bristol 170	1,390	N.A.	N.A.	N.A.	Operated by Silver City Airways under 12 month concession from Libyan Government, thereafter to be replaced by locally-financed company to be managed by Silver City. Began operations in February, 1953.
LUXEMBOURG							
Société Luxembourgeoise de Navigation Aérienne (Luxembourg Airlines)	Avenue Marie-Therese 6, Luxembourg Man. Dir.: H. L. Heguy	Douglas DC-3's	—	—	—	—	—
MALAYA							
Federation Air Services	Kuala Lunpur	5 D.H. Beaver	—	—	—	—	A subsidiary of Malayan Airways providing scheduled internal services operated on behalf of the Federation Government.
Malayan Airways Ltd.	Ocean Building, Collyer Quay, Singapore Managed by Mansfield & Co., Ltd. Chairman: F. L. Lane Man. Dir.: R. P. Mollard Man.: J. Skeldon	11 Douglas DC-3 2 D.H. Rapide	4,763	2,418,724	138,372	Freight: 4,942,000 lb. Mail: 1,066,000 lb.	Sabah Airways Ltd. is a wholly-owned subsidiary. Fleet as at March 4, 1953.
MALTA							
Malta Airways Ltd.	Phoenicia Hotel, The Mall, Valletta Chairman: Lt.-Col. R. G. Strickland	—	—	—	—	—	Services operated by B.E.A.
MEXICO							
Aeronaves de Mexico S.A.	Balderas 32, Mexico City Pres.: Antonio Diaz Lombardo Gen. Man.: Carlos Ramos Ops. Man.: Robert L. Johnson	1 Douglas DC-4 8 Douglas DC-3 *On order:* 3 Convair 340 for delivery in 1953	1,689	3,353,022	65,440,391 pass-miles	1,471,712 lb.	An affiliate of Pan American World Airways, Inc.
Aero Transportes S.A. (A.T.S.A.)	Av. Juárez 117-A, Mexico, D.F. Pres.: R. O'Farril Gen. Man.: H. J. Filsinger	4 Douglas DC-3	1,594	337,886	7,733	329,210 lb.	Operates in conjunction with Compañía Mexicana de Aviación S.A., from whom aircraft are leased. Combines the pooled resources of Aerovias Latino-Americanos S.A. (A.L.A.S.A.), Aerovias Transcontinentales S.A. and Transportes Aereos de Jalisco S.A. (T.A.J.S.A.).
Aerovias Guest S.A.	Paseo de la Reforma 95, Mexico City Pres.: Winston Guest Gen. Man.: George L. Monteiro Ops. Man.: Durston G. Richardson	3 Douglas DC-4	5,756	937,090	16,956	—	—
Aerovias Latino-Americanos S.A. (A.L.A.S.A.)	Villahermosa, Tabasco, Mexico	1 Douglas DC-3	—	—	—	—	Operates as a part of Aero Transportes S.A. (A.T.S.A.).
Aerovias Reforma S.A. (Reforma)	Aeropuerto Central, Apartado Postal 9648, Mexico City Gen. Man.: Carlos Ramos Ops. Supt.: Mario A. Barnet	10 Douglas DC-3	3,760	—	—	—	—
Aerovias Transcontinentales S.A.	3-905 Dolores, Mexico City	1 Douglas DC-3	—	—	—	—	Operates as a part of Aero Transportes S.A. (A.T.S.A.).
Compania Mexicana de Aviacion S.A. (C.M.A.)	Balderas 36, Mexico City Pres.: Aaron Saenz Gen. Man.: Elton R. Silliman Ops. Man.: Marcial Huerta Jones	2 Douglas DC-6 6 Douglas DC-4 19 Douglas DC-3 *On order:* 2 Douglas DC-6B for delivery in 1953	5,484	12,917,623	434,410	32,084,474 lb.	An affiliate of Pan American World Airways, Inc.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
MEXICO—*cont.*							
Lineas Aereas del Pacifico S.A. (L.A.P.S.A.)	40, Avenida Ruiz, Ensenada, B. Cfa., Mexico	—	—	—	—	—	Now re-named Trans Mar de Cortes S.A. which see.
Lineas Aereas Mexicanas S.A. (L.A.M.S.A.)	Paseo de la Reforma 1, Mexico City Pres. and Gen. Man.: A. F. Bonnalie	5 Douglas DC-3	1,500	—	—	—	United Air Lines holds a controlling interest in L.A.M.S.A.
Lineas Asociadas Mexicanas S.A.	Balderas 32, Mexico, D.F. Pres.: Miguel Aleman Gen. Man.: Carlos Ramos	—	—	—	—	—	—
Trans Mar de Cortés S.A.	Avenida Serdan 227-229, P.O. Box 54, Guaymas, Sonora Man. Dir.: Mayo Obregon T Gen. Man.: Luis Coppola B	3 Douglas DC-3	2,360	—	—	—	Formerly Lineas Aereas del Pacifico S.A. (L.A.P.S.A.).
Transportes Aereos de Jalisco S.A.	Pedro Moreno 602, Guadalajara, Jal. Gen. Man.: Tl. R. Gillenwaters	2 Douglas DC-3 *On order:* 2 Douglas DC-3 for delivery in 1953	520	275,498	34,881	N.A.	Operates as a part of Aero Transportes S.A. (A.T.S.A.).
Transportes Aereos Mexicanos S.A. (T.A.M.S.A.)	Calle 62, No. 495, Merida, Yucatan Pres.: Arturo Ponce Canton	2 Douglas DC-3	1,317	—	—	—	—
Transportes Aereos Tampico S. de R.L. de C.V. (T.A.T.)	Olmos y Altamira, Tampico Pres.: Felipe Gutierrez de Lara	3 Douglas DC-3 2 Avro Anson	1,184	—	—	—	—
NETHERLANDS							
Koninklijke Luchtvaart Maatschappij N.V. (K.L.M.—Royal Dutch Airlines)	Badhuisweg 260, The Hague Pres.: Dr. Albert Plesman Exec. Vice-Pres.: F. von Balluseck (Traffic) F. Besancon (Production) M. J. van der Ploeg (Finance and Accounts) Dr. L. H. Slotemaker (Air Policy) Vice-Pres., Ops.: J. J. van Balkom	9 Lockheed Super Constellation 1049C 15 Lockheed Constellation 749A 7 Douglas DC-6B 2 Douglas DC-6A 6 Douglas DC-6 7 Douglas DC-4 12 Douglas DC-3 6 Convair 340 11 Convair 240 *On order:* 4 Lockheed Super Constellation 1049C 6 Convair 340 for delivery 1954	112,909	27,748,700	517,075	Freight: 31,639,135 lb. Mail: 4,359,918 lb.	State holds 96% of shares, private interests 4%.
NETHERLANDS WEST INDIES							
Koninklijke Luchtvaart Maatschappij N.V. (K.L.M.—Royal Dutch Airlines, West Indies Division)	de Ruyterkade 3, Willemstad, Curaçao	3 Douglas DC-4 8 Douglas DC-3	—	—	—	—	
NEW GUINEA							
Gibbes Sepik Airways Ltd.	P.O. Box 41, Port Moresby, Papua Territory Chairman: W. G. Matthew Man. Dir.: R. H. Gibbes	1 Lockheed Lodestar 7 Noorduyn Norseman 2 Auster *On order:* 2 Noorduyn Norseman	5,546	—	—	—	Operates scheduled passenger and freight services.
Mandated Airlines Ltd.	Lae, New Guinea	Douglas DC-3 D.H. Dove D.H. Rapide	—	—	—	—	Operates local scheduled services.
NEW ZEALAND							
New Zealand National Airways Corporation (N.Z.N.A.C.)	G.P.O. Box 3038, Wellington Chairman: Sir Leonard Isitt Gen. Man.: J. J. Busch	21 Douglas DC-3 4 D.H. Heron 6 D.H. Rapide 3 D.H. Fox Moth	6,397	5,341,048*	307,453*	12,828,298 lb.*	*Year ended March 31, 1952.
Tasman Empire Airways Ltd. (T.E.A.L.)	P.O. Box 2201, Mechanics' Bay, Auckland Chairman: Sir Leonard M. Isitt Gen. Man.: G. N. Roberts Ops. Man.: K. A. Brownjohn	5 Short Solent	8,584	1,817,547	42,301	1,856,309 lb.	Jointly owned by the Governments of New Zealand 50%, Australia 30% and the United Kingdom 20%. Fleet as at March 31, 1953.
NICARAGUA							
Compãnia Nacional TACA de Nicaragua S.A.	Managua Pres. and Gen. Man.: Louis E. C. Curen, Jr. Vice-Pres.: Mariano Arguello	—	—	—	—	—	A former subsidiary of the TACA Group. Now a Nicaraguan company

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
NICARAGUA *cont.*							
Lineas Aéreas de Nicaragua S.A. (La Nica)	Managua Gen. Man.: Guillermo Xuelà	*7 Douglas DC-3 1 Ryan Navion Super 260	1,546	904,744	29,218	32,372,000 lb.	An affiliate of Pan American World Airways, which holds a 20% interest. Remainder of stock held in Nicaragua, 10% by Government and 70% privately. *As at March 5, 1953.
NORWAY							
Braathen's South American and Far East Airtransport A S (S.A.F.E.)	Fr. Nansens plass 7, Oslo Chairman: A. Undall Pres.: Ludwig G. Braathen Ops Man.: J. Rad	2 Douglas DC-4 1 Douglas DC-3 2 D.H. Heron *On order:* 2 Lockheed Super Constellation 1049C for delivery 1953-54	9,139	1,075,295	10,980	996,000 lb.	
Det Norske Luftfartselskap A S (D.N.L.)	Fornebu Airport, Oslo Chairman of Board: Per M. Hansson Pres.: O. Steen					—	A non-operating holding company in the S.A.S. consortium. See under "Scandinavia."
Fred Olsen Flyselskap A S	Fred Olsens Gate, Oslo, 2 Man.: Helge Dahl	1 Douglas DC-4 4 Douglas DC-3					
Vestlandske Luftfartselskap A S (West-Norway Airlines)	Bergen	2 Short Sealand 1 Supermarine Walrus 3 Republic Seabee					Operates services to Stavanger and Trondheim.
Wideroe's Flyveselskap og Polar-Fly A S	Oslo	Noorduyn Norseman				—	Operates a summer seasonal service between Narvik and Flodö.
PACIFIC TRUST TERRITORY							
Transocean Air Lines	Guam Man.: V. Lakin	4 Convair Catalina amph.	2,613	—		—	Transocean, an American non-scheduled air carrier, operates scheduled services linking the Mariana, Caroline and Marshall archipelagos under contract to the United Nations' Trustee (U.S.A.) of the former Japanese mandated Pacific islands.
PAKISTAN							
Crescent Air Transport Ltd.	14, Swaminarayan Building, Frere Road, Karachi Man. Dir.: M. Hidayaltulah	1 Douglas DC-3 8 D.H. Rapide					Operates internal services in Pakistan.
Orient Airways Ltd.	Orient House, Karachi Airport Chairman: M. M. Ispahani Gen. Man.: M. M. Salim Ops. Man.: R. St. Emmmore	2 Convair 240 16 Douglas DC-3 1 Beechcraft 2 Convair Stinson Sentinel	5,511	2,980,348	98,875	Freight: 6,515,264 lb. Mail: 447,104 lb.	Fleet as at March 19, 1953.
Pakistani International Air Lines		*On order:* 3 Lockheed Super Constellation 1049C					State airline in process of formation for international operations.
PANAMA							
Compânia Panamena de Aviacion S.A. (C.O.P.A.)	Avenida Peru 25, Panama, R.P. Pres.: Ricardo Arias, Jr. Vice-Pres.: Carlos Icaza Gen. Man.: Raymond A. Norton	2 Douglas DC-3	542				P.A.W.A. holds a 33% interest.
PARAGUAY							
Linea Aerea de Transporte Nacional (L.A.T.N.)	Asuncion		2,169				
PERU							
Aerovias Nacionales del Sur S.A.	Camena No. 199, Lima Pres.: V. L. Berto Martinto	3 Curtiss Commando		—	—	—	
Compania de Aviacion Faucett S.A.	Hotel Bolivar No. 926, P.O. Box 1429, Lima Pres.: Eduardo Dibos D.	4 Douglas DC-4 7 Douglas DC-3 6 Faucett	4,805				

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
PERU *–cont.*							
Grupo de Transportes	Limatambo Airport, Apartado 1414, Lima Dir.: Col. F. A. P. Juan Castro Ramos	8 Douglas DC-3 4 Convair Catalina amph. 6 D.H. Rapide 4 D.H. Beaver 1 Beechcraft 3 Stinson	3,500	—	—	—	Formerly Transportes Aereos Militares (T.A.M.). Operated by the Peruvian Air Force.
PHILIPPINES							
Philippine Air Lines, Inc. (P.A.L.)	M.R.S. Building, Plaza Cervantes, Manila Pres.: Andres Soriano Vice-Pres.: A. M. Macleod Ops. Man.: Delos Thurber	2 Douglas DC-6B 4 Douglas DC-6 35 Douglas DC-3 3 Convair 340 *On order:* 3 Convair 340	24,500*	—	—	—	*As at March 6, 1953.
POLAND							
Polskie Linie Lotnicze (LOT)	Rue Hoza 39, Warsaw Gen. Man.: Sergiusz Minorski	12 Ilyushin IL-12 26 Li-2 4 Douglas DC-3 Acro 45	5,511	—	—	—	
PORTUGAL							
Aero Portuguesa Lda. (A.P.)	Avenida da Liberdade 120, Lisbon Pres.: Antonio de Medeiros e Almeida Vice-Pres.: Frederico Pereira da Vasconcelos	1 Douglas DC-3 1 Lockheed Lodestar	461	—	—	—	Ceased operations May 4, 1953 under terms of an agreement with the Portuguese Government. Routes operated have now been taken over by Transportes Aereos Portugueses (T.A.P.).
Transportes Aéreos Portugueses (T.A.P.)	Rua Braamcamp 2, Lisbon Chairman: Francisco de Mello e Castro Pres.: Dr. Ricardo Ribeiro de Espiritu Santo Silva Vice-Pres.: Dr. Jose Simoes Neves	3 Douglas DC-4 6 Douglas DC-3 1 Beechcraft	7,193*	884,720	17,076	Freight: 165,884 lb. Mail: 155,594 lb.	Formerly State-owned Became a private concern on June 1, 1953. *As at May 31, 1953.
PORTUGUESE AZORES							
Sociedade Açoriana de Transportes Aéreos Lda. (S.A.T.A.)	Rua dos Meriadores, Ponta Delgado Pres. and Ops. Man.: M. M. Rocha Traffic Man.: F. de M. Ramos	2 D.H. Dove	380	—	—	—	Operates inter-island services.
PORTUGUESE EAST AFRICA							
Divisão de Exploração dos Transportes Aéreos (D.E.T.A.)	Rua Aráujo 103, Lourenco Marques, Mozambique Dir.: Lt.-Col. Pinto da Cunha	3 Douglas DC-3 2 Lockheed Lodestar 1 Lockheed 14 2 Junkers Ju.52/3m 6 D.H. Dove 4 D.H. Rapide 1 D.H. Dragonfly 2 D.H. Hornet Moth	2,547	1,414,981	14,854	411,292 lb.	State-owned.
PORTUGUESE TIMOR							
Transportes Aéreos de Timor (T.A.T.)	Dili Airport, Timor Pres.: Cardoso Dias	1 D.H. Dove 1 Avro Anson	250	39,433	225	Freight: 6,520 lb. Mail: 3,649 lb.	Owned by the Portuguese Government.
PORTUGUESE WEST AFRICA							
Divisão de Exploração dos Transportes Aéreos (D.T.A.)	Caixa Postal 79, Luanda, Angola Sec. Gen.: Luciano Julio Rosa Traffic Man.: Guilherme da Costa Carvalho	5 Douglas DC-3 5 Beechcraft D18 7 D.H. Rapide	3,474	863,811	18,722	—	State-owned.
Serviço de Transportes Aéreos (S.T.A.)	Caixa Postal 11, S. Tomé Man.: Adelino Faria de Figueiredo	2 D.H. Rapide 1 Auster Autocar	350	—	120,730 pass.-km.	—	
PUERTO RICO							
Caribbean-Atlantic Airlines, Inc. (Caribair)	P.O. Box 3214, San Juan Pres.: Dionisio Trigo Vice-Pres.: Benigno Trigo Vice-Pres., Ops.: Jose M. Sierra	3 Douglas DC-3	377*	8,757,000 rev. pass.-miles	109,222	42,076 ton-miles	*As at March, 1953.
RUMANIA							
Transporturi Aeriene Romana Sovietica (T.A.R.S.)	Strada Nicolae Iorga 11, Bucharest Pres.: V. M. Korotcov Ass. Dir.: V. Craescu Ops. Man.: M. Pavlovski	16 Li-2 *5 IL-12	1,589	—	—	—	*Unconfirmed.
SAUDI ARABIA							
Saudi Arabian Airlines	Jeddah Dir.: H.R.H. Prince Emir Mishaal Supt. Ops.: W. E. Blankenship	5 Douglas DC-4 13 Douglas DC-3 5 Bristol Type 170 Wayfarer	2,625	—	—	—	Owned by Saudi Arabian Government and managed under contract by T.W.A.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
SCANDINAVIA							
Scandinavian Airlines System (S.A.S.)	Bromma Airport Stockholm 40. Pres.: Per A. Norlin Exec. Vice-Pres.: Per M. Backe and V. J. Rasmussen	8 Douglas DC-6B 12 Douglas DC-6 9 Douglas DC-4 15 Douglas DC-3 6 Saab Scandia 2 Junkers Ju. 52 *On order:* 6 Douglas DC-6B for delivery in 1953	59,674*	16,933,428	568,292	Freight: 18,745,794 lb. Mail: 6,507,418 lb.	*As at March 6, 1953.
SOUTH AFRICA							
Commercial Air Services (Pty.) Ltd. (Comair)	P.O. Box 2245 Johannesburg Man. Dir.: L. Zimmerman Ops. Man.: J. M. S. Martin	2 Lockheed Lodestar 4 Cessna 195 4 Cessna 170 5 Cessna 140	250	217,576	6,045	Freight: 322,560 lb. Mail: 38,080 lb.	Commercial Air Services (Rhod.) (Pty.) Ltd. is a subsidiary in which the Company holds a 54% interest. Commercial Air Services Natal (Pty.) is a wholly owned subsidiary. The Company is an Associate of Airwork Ltd., London. Fleet as at May 18, 1953.
Pan African Airways Ltd.	Anan House, Commissioner Street, Johannesburg Chairman: Charles Keyser	Avro Tudor Mk. 5	—	—	—	—	Operates fortnightly passenger and freight services between Johannesburg and Europe.
South African Airways (S.A.A.)	Rand Airport, Germiston, Johannesburg Chief Airways Man.: Major-Gen. C. J. Venter Chief Airways Supt.: J. D. T. Louw	4 Lockheed Constellation 7 Douglas DC-4 3 Douglas DC-3 11 Lockheed Lodestar	14,609	5,718,991	168,335	Freight: 1,253,433 ton-miles Mail: 1,951,895 ton-miles	Owned and operated by the Railway and Harbours Administration of the Government of the Union of South Africa.
South West Air Transport (Pty.) Ltd.	Windhoek	Ryan Navions	—	—	—	—	Operates a twice weekly service between Windhoek and Grootfontein.
SOVIET UNION							
Glavnoe Upravienie Grazhdanskogo Vozdushnogo Flota (Aeroflot)	Hotel Metropol, Sverdlova, Moscow Head of Administration: Lt. Gen. of Aviation Georgyi Baidukov Deputy Head: General of Aviation Ase'evich	Illyushin IL-18 Illyushin IL-12 Li-2 Yakovlev Yak-16 ShchE-2	57,500†	—	—	—	Total fleet strength is in excess of 400 aircraft. †Approx.
SPAIN							
Compania Mercantil de Lineas Aereas Espanolas (Iberia)	Plaza de Canovas del Castillo 4, Madrid Pres.: Jesus Rubio Paz Gen. Man.: Cesar Gomez Lucia Ops. Supt.: Jose Ma. Ansaldo	6 Douglas DC-4 15 Douglas DC-3 4 Bristol Type 170 1 Junkers Ju.52/3m 1 D.H. Rapide 1 Airspeed Consul *On order:* 3 Lockheed Super Constellation L-1049	32,937	6,295,340	409,975	—	—
Aviacion y Comercio S.A. (Aviaco)	Calle Aduana 33, Madrid Dir. Gen.: José Pazó Montes Dep. Dir. Gen.: Nicolas de Gaminde Guimon	2 S.E. 161 Languedoc 2 Bristol Type 170 Mk. 31E 6 Bristol Type 170 Mk. 21E *On order:* 1 S.E. 161 Languedoc for delivery in 1953	10,600	1,291,925	144,859	Freight: 1,138,000 lb. Mail: 176,180 lb.	—
SWEDEN							
Aktiebolaget Aerotransport (A.B.A.)	Bromma Airport, Stockholm 40 Chairman of Board: Axel Gjores Pres.: Karl Lignell		—	—	—	—	A non-operating holding company in the S.A.S. consortium. See under "Scandinavia."
SWITZERLAND							
Schweizerische Luftverkehr A.G. (Swissair)	Hirschengraben 84, Zurich Pres.: Dr. Walter Berchtold Ops. Man.: Franz Zimmermann	3 Douglas DC-6B 3 Douglas DC-4 13 Douglas DC-3 4 Convair 240 3 D.H. Rapide *On order:* 3 Douglas DC-6B for delivery in 1953	23,188	6,453,277	292,341	Freight: 8,535,573 lb. Mail: 3,861,945 lb.	State holds a 30% interest. Swissair Photo Ltd. is a wholly owned subsidiary. Fleet as at March 1, 1953.
SYRIA							
Syrian Airways	P.O. Box 417 Damascus Pres.: Jean Schnaoui	2 Douglas DC-3 *On order:* 2 Douglas DC-3 for delivery in 1953	1,050	535,500	8,426	463,050 lb.	State-owned. Fleet as at May 6, 1953
THAILAND							
Thai Airways Company, Ltd. (T.A.C.)	Airway Building, 6, Lan Luang Road, Bangkok Man. Dir.: Maj.-Gen. Chai Prathipasen Head Ops. Dept.: S/Ldr. Luang Takol Napakas	1 Douglas DC-4 6 Douglas DC-3 6 Noorduyn Norseman 3 Beechcraft Bonanza	7,138	—	—	—	Government holds 95% of capital.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
TURKEY							
Turkiye Devlet Hava Yollari (D.H.Y.)	Umum Müdürlügü, Ankara Gen. Man.: Osman Nuri Baykal Ops. Man.: Nuri Dural	26 Douglas DC-3	5,998*	1,857,029	127,935	4,729,758 lb.	State-owned. Fleet as at May 27, 1953.
URUGUAY							
Compãnia Aeronautica Uruguaya S.A. (CAUSA)	Calle Colonia 1068, Montevideo Pres.: J. Americo Beisso Vice-Pres.: Dr. Federico Fleurquin Man.: Raul Montero Zorrilla	3 Short Sandringham	154	—	—	—	—
Primeras Lineas Uruquayas de Navigacion Aerea (P.L.U.N.A.)	Calle Uruguay 1107, Montevideo Pres.: Gen. Pedro Sicco Gen. Man.: Delfin Diaz Cibils Ops. Man.: Roberto Langon	5 Douglas DC-3	1,284	—	—		—
U.S.A.							
Aerovias Sud Americana, Inc.	Pinellas International Airport, St. Petersberg, Florida Pres. and Gen. Man.: Victor V. Carmichael, Jr. Vice-Pres.: C. Booker Powell Ops. Man.: Henry C. Palmer	Curtiss Commandos	—	—	—	—	Operates freight services to Belize, Bogota, El Salvador, Guatemala and Havana.
Allegheny Airlines, Inc.	Washington National Airport, Washington 1, D.C. Chairman: Robert M. Love Pres.: Leslie O. Barnes	12 Douglas DC-3	2,281	—	179,985	2,845,530 ton-miles	Formerly All American Airways
Alpena Air Service	Phelps Collins Airport, Alpena, Michigan Man.: Robert C. Welch		—	—	—	—	Operates scheduled services within the State of Michigan.
American Airlines Inc.	100, Park Avenue, New York 17, N.Y. Pres.: C. R. Smith Vice-Pres., Ops.: Lawrence G. Fritz	17 Douglas DC-6B 49 Douglas DC-6 14 Douglas DC-4 78 Convair 240 *On order:* 3 Douglas DC-6A 25 Douglas DC-7	10,825	89,444,215	5,094,191	Freight: 44,910,546 lb. Mail: 17,564,183 ton-miles	American Airlines de Mexico, S.A. is a wholly owned subsidiary. Fleet as at April 27, 1953.
Baca Airlines	Memorial Airport, Jefferson City, Missouri Pres. and Gen. Man.: J. Raymond Brummet Vice-Pres.: E. T. Tennyson	1 Cessna T-50 1 Cessna 170 2 Stinson V.77	264	—	—	—	—
Bonanza Air Lines, Inc.	P.O. Box 391, McCarren Field, Las Vegas, Nevada Pres.: Edmund Converse Vice-Pres.: Wesley J. Durston Vice-Pres., Ops.: Myron W. Reynolds	5 Douglas DC-3	1,311	1,274,310	43,705	552,937 lb.	Operates scheduled inter-state services.
Braniff Airways, Inc.	Love Field, Dallas 9, Texas Pres.: T. E. Braniff Exec. Vice-Pres.: Charles E. Beard Ops. Man.: R. B. Carleton	9 Douglas DC-6 9 Douglas DC-4 25 Douglas DC-3 26 Convair 340	14,533	20,430,280	1,050,789	5,533,333 ton-miles	Merged with Mid-Continent Airlines, Inc. on August 16, 1952, retaining the name of Braniff.
California Central Airlines	Lockheed Air Terminal, Burbank, California Pres. and Dir., Ops.: Col. C. C. Sherman Vice-Pres.: G. P. Coulter	1 Lockheed Constellation 049 5 Martin 2-0-2 2 Douglas DC-3 1 Lockheed 12A	624	—	—	—	Operates scheduled inter-State services.
Capital Airlines, Inc.	Washington National Airport, Washington 1, D.C. Pres.: J. H. Carmichael Vice-Pres., Ops.: J. B. Franklin	7 Lockheed Constellation 049 and 749 25 Douglas DC-4 25 Douglas DC-3 *On order:* 5 Lockheed Constellation for delivery in 1953	5,160	26,970,953	2,011,264	8,768,615 ton-miles	—
Central Airlines, Inc.	Meacham Field, Fort Worth, Texas Chairman: F. Kirk Johnson Pres. and Gen. Man.: Keith Kahle Vice-Pres., Ops.: R. E. Harding, Jr.	6 Douglas DC-3	1,192*	1,743,428	43,011	Freight: N.A. Mail: 382,654 lb. 812,004 ton-miles	*As at April 26 1953.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
U.S.A.—*cont.*							
Chicago and Southern Airlines, Inc.	Municipal Airport, Memphis 14, Tennessee Chairman: Carleton Putman Pres.: S. A. Stewart Vice-Pres., Ops.: William T. Arthur	6 Lockheed Constellation 649B 12 Douglas DC-3	5,854*	11,280,000	515,442	4,272,747 ton-miles	Merged with Delta Air Lines, Inc. on May 1, 1953 to form Delta - C&S Airlines. *As at December 31, 1952.
Colonial Airlines, Inc.	230, Park Avenue, New York, 17, N.Y. Chairman: Edmond M. Hanrahan Pres.: Branch T. Dykes Exec. Vice-Pres. and Gen. Man.: Donald A. Duff	*4 Douglas DC-4 8 Douglas DC-3	2,956*	5,027,291	318,302	497,681 ton-miles	*As at March 1, 1953.
Continental Air Lines, Inc.	Stapleton Airfield Denver 7, Colorado Pres.: Robert F. Six Exec. Vice-Pres.: C. C. West, Jr. Vice-Pres., Ops.: O. R. Haueter	6 Convair 340 2 Convair 240 10 Douglas DC-3 *On order:* 3 Douglas DC-6B 1 Convair 340 for delivery in 1953	2,935*	139,000,635 pass. miles	348,633	5,873,068 lb.	*As at March 11, 1953.
Delta Air Lines Inc.	Municipal Airport, Atlanta, Georgia Pres. and Gen. Man.: C. E. Woolman Vice-Pres., Ops.: Charles H. Dolson	7 Douglas DC-6 5 Douglas DC-4 20 Douglas DC-3	3,061	442,604,584 rev. pass. miles	972,264	Freight: 15,922,896 lb. Express: 5,670,028 lb. Mail: 8,344,824 lb.	Merged with Chicago and Southern Airlines, Inc. on May 1, 1953, to form Delta - C&S Airlines.
Delta - C&S Air Lines, Inc.	Chairman: Carleton E. Putnam Pres.: C. E. Woolman Vice-Pres., Ops.: Charles H. Dolson	7 Douglas DC-6 6 Lockheed Constellation 649A 30 Douglas DC-3 5 Convair 340 *On order:* 15 Convair 340 in course of delivery during 1953 4 Douglas DC-7 for delivery in 1954	9,508	—	—	—	Formed on May 1, 1953, by the merger of Delta Air Lines, Inc. and Chicago and Southern Air Lines, Inc. Fleet as at May 17, 1953.
Eastern Air Lines, Inc.	10, Rockefeller Plaza, New York 20, N.Y. Pres.: E. V. Rickenbacker First Vice-Pres.: Paul H. Brattain Vice-Pres., Ops.: S. L. Shannon	14 Lockheed Super Constellation 1049A 20 Lockheed Constellation 749 60 Martin 4-0-4 11 Douglas DC-4 *On order:* 16 Lockheed Super Constellation 1049C for delivery in 1953	13,648	69,164,108	3,928,898	Freight: 16,094,373 lb. Air Express: 19,624,112 lb. Mail: 23,772,211 lb.	—
Empire Air Lines, Inc.	P.O. Box 268, Boise, Idaho Pres.: Joe Lux Vice-Pres.: Gwinn Hicks Ops. Man.: G. T. Cooke	5 Douglas DC-3	754	—	—	—	Absorbed by West Coast Airlines, Inc. on August 4, 1952.
The Flying Tiger Line, Inc.	Lockheed Air Terminal, Burbank, Calif. Pres.: Robert W. Prescott Vice-Pres.: George T. Cussen Supt., Ops.: John P. Goldsmith	12 Douglas DC-4 26 Curtiss Commando *On order:* 5 Douglas DC-6A	10,506	—	—	41,584,387 ton-miles	Fleet as at April 27, 1953. Scheduled mail and freight services only. Has merged with Slick Airways, Inc.
Frontier Airlines, Inc.	Stapleton Airfield, Denver 7, Colorado Pres.: H. S. Darr Exec. Vice-Pres.: C. A. Myhre Vice-Pres., Ops.: R. M. Wilson	12 Douglas DC-3	3,215	32,944,000 rev. pass. miles	125,525	618,507 ton-miles	—
Helicopter Air Service, Inc.	5036, W. 63rd Street Chicago 38, Illinois Pres.: T. Hamil Reidy Vice-Pres., Ops.: C. W. Moore	6 Bell Model 47D	350	—	No passengers carried	28,966 ton-miles (mail only)	Operates helicopter mail services in Chicago area.
Inland Air Lines, Inc.	Denver, Colorado	1 Douglas DC-4 4 Douglas DC-3	1,613	—	—	—	Merged with Western Air Lines, Inc. early in 1952.
Island Air Service	Port Clinton, Ohio	4 Ford Tri-motor	—	—	—	—	Operates scheduled services to islands in Lake Erie
Lake Central Airlines, Inc.	Weir Cook Municipal Airport, Indianapolis 44, Indiana Pres.: R. B. Stewart Vice-Pres.: Lloyd W. Hartman Vice-Pres., Ops.: Robert W. Clifford	7 Douglas DC-3 1 Curtiss Commando	—	—	—	—	—

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
U.S.A.—*cont.*							
Los Angeles Airways, Inc.	5901, W. Imperial Highway, Los Angeles, 45, California Pres.: Clarence M. Belinn Ops. Man.: Fred W. Milam	3 Sikorsky S-55 3 Sikorsky S-51	332	—	—	—	Scheduled passenger and mail helicopter services in the Los Angeles area.
Massachusetts Air Industries	Municipal Airport, New Bedford, Mass. Man.: Raymond W. Mattes	1 Cessna T-50 1 Noorduyn 2 Ryan Navion 7 Cessna 140 2 Cessna 170 4 Piper 1 Republic Seabee	—	—	—	—	Scheduled services within the State of Massachusetts.
Mid-Continent Airlines, Inc.	102, East 9th Street, Kansas City 6, Missouri Chairman: Thomas F. Ryan Pres. and Gen. Man.: J. W. Miller Vice-Pres., Ops.: John A. Cunningham	4 Convair 240 23 Douglas DC-3	4,052	—	—	—	Merged with Braniff Airways, Inc. on August 16, 1952. Fleet and route mileage as at January 1, 1952.
Midet Aviation Corporation	Palm Beach International Airport, West Palm Beach, Florida Pres.: Joseph Mundet Vice-Pres.: Nelson A. Miles	Douglas DC-3's	—	—	—	—	Scheduled services between Florida and the Bahamas.
Midway Airlines, Inc.	Sky Harbor Airport, Northbrook, Illinois Pres.: Hugh Riddle	2 Cessna 195A	—	—	—	—	Operates scheduled shuttle services in the Chicago area.
Mid-West Airlines, Inc.	Municipal Airport, Omaha, Nebraska Pres.: F. C. Anderson Vice-Pres.: Dr. B. C. Barnes	*Douglas DC-3 †6 Cessna 190	—	—	—	—	A wholly-owned subsidiary of the Purdue Aeronautics Corporation. Ceased operations on May 12, 1952 upon non-renewal of its certificate by the CAB. *Several purchased but not put into operation. †Original operating fleet.
Mohawk Airlines, Inc.	Cornell University Airport, Ithaca, New York Pres.: E. V. Underwood Vice-Pres.: Robert E. Peach Vice-Pres., Ops.: Carl A. Benscoter	10 Douglas DC-3	899	1,905,709	105,983	133,787 lb.	Formerly Robinson Airlines, Inc. Fleet as at April 15, 1953.
National Airlines, Inc.	3240, Northwest 27th Avenue, Miami 42, Florida Pres.: G. T. Baker Vice-Pres., Ops.: E. J. Kershaw	8 Douglas DC-6B 7 Douglas DC-6 3 Douglas DC-4 11 Lockheed Lodestar 2 Curtiss Commando *On order:* 4 Douglas DC-7 8 Convair 340 for delivery in 1953	2,829	17,114,195	785,681	Freight: 5,477,613 ton-miles Mail: 1,383,763 ton-miles	
New York Airways, Inc.	P.O. Box. 426, New York Airport Station, Flushing 71, N.Y. Chairman: John L. Senior, Jr. Pres.: Robert L. Cummings, Jr. Ch. Eng. & Ops. Man.: Jack E. Gallagher	3 Sikorsky S-55 *On order:* 4 Sikorsky S-55	—	—	—	—	Started helicopter mail services in N.Y. area in December, 1952.
North Central Airlines, Inc.	3300, University Avenue, S.E., Minneapolis 14, Minnesota Chairman: Arthur E. A. Mueller Pres.: Howard A. Morey Ops. Man.: Robert J. Ceronsky	14 Douglas DC-3 *On order:* 5 Douglas DC-3	2,573*	2,859,158	153,047	Express: 138,341 ton-miles Mail: 94,696 ton-miles	Formerly Wisconsin Central Airlines, Inc. *As at March 31, 1953.
Northeast Airlines, Inc.	Logan International Airport, 239, Prescott Street, East Boston 28, Mass. Chairman: Paul F. Collins Pres.: George E. Gardner Vice-Pres., Ops.: A. A. Lane	4 Convair 240 9 Douglas DC-3	2,295*	83,675,411 rev. pass. miles	427,685	584,670 ton-miles	*As at March, 1953.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
U.S.A.—*cont.*							
Northwest Airlines, Inc.	1885, University Avenue, St. Paul 1, Minnesota Pres.: Harold R. Harris Exec. Vice-Pres.: Malcolm S. Mackay Vice-Pres., Ops.: Frank C. Judd	10 Boeing Stratocruiser 24 Douglas DC-4 8 Douglas DC-3 *On order:* 6 Lockheed Super Constellation 1049C for delivery 1954/5	16,792*	23,210,634	937,900	Freight: 13,501,501 ton-miles Mail: 5,017,993 ton-miles	*As at March 1, 1953. Operates under popular name of Northwest Orient Airlines.
Ozark Air Lines, Inc.	Box 6, Lambert Field, St. Louis 21, Missouri Chairman: Barak T. Mattingly Pres.: Laddie H. Hamilton Ops. Man.: F. E. Myers	10 Douglas DC-3	1,861	14,133,000 rev. pass.-miles	84,426	110,919 ton-miles	—
Pan American-Grace Airways, Inc. (Panagra)	135-East 42nd Street, New York 17, N.Y. Pres.: Andrew B. Shea Vice-Pres. & Gen. Man.: Douglas Cambell Vice-Pres., Ops.: Thomas J. Kirkland	2 Douglas DC-6B 6 Douglas DC-6 4 Douglas DC-4 10 Douglas DC-3	8,784	6,237,311	122,693	7,528,640 lb.	—
Pan American World Airways, Inc.	135, East 42nd Street, New York 17, N.Y. Pres.: Juan T. Trippe Vice-Pres.: Henry J. Friendly	18 Douglas DC-6B 28 Boeing Stratocruiser 14 Lockheed Constellation 049 44 Douglas DC-4 9 Douglas DC-3 14 Convair 240 1 Douglas B-23 *On order:* 47 Douglas DC-6B 3 D.H. Comet Series 3	61,974	60,184,727	1,426,409	Freight: 51,617,000 ton-miles Mail: 17,000,000 ton-miles	—
Piedmont Aviation, Inc.	Winston-Salem, North Carolina Pres.: T. H. Davis Vice-Pres. Traffic: R. D. Hager Vice-Pres., Ops.: H. K. Saunders	14 Douglas DC-3	2,598	5,026,904	224,702	2,008,594 lb.	Formerly Piedmont Airlines.
Pioneer Air Lines, Inc.	Love Field, Dallas 9, Texas Chairman: W. F. Long Pres.: Robert J. Smith Vice-Pres., Ops.: H. B. Seifert	9 Martin 2-0-2	1,972	3,849,793	183,271	Freight: 177,045 ton-miles Mail: 125,893 ton-miles	—
Provincetown-Boston Airline, Inc.	Provincetown, Mass. Owner and Operator: John C. Van Arsdale	1 Lockheed Electra 2 Cessna T-50	48	—	5,044	—	Operates scheduled service between Boston and Cape Cod.
Resort Airlines, Inc.	P.O. Box 242, International Airport, Miami 48, Florida Pres.: Walter Sternberg, Jr. Exec. Vice-Pres.: Harold L. Graham, Jr. Vice-Pres., Ops.: Robert C. Goodman	—	—	—	—	—	—
Riddle Airlines, Inc.	International Airport, Miami, Florida. Pres.: John P. Riddle Vice-Pres.: J. G. Helvey	9 Curtiss Commando	—	—	—	Freight: 10,272,673 ton-miles	Scheduled all-freight service between New York and Puerto Rico *via* Miami.
Robinson Airlines, Inc.	121, East Seneca Street, Ithaca, New York	—	—	—	—	—	Re-named Mohawk Airlines, Inc., which see.
Slick Airways, Inc.	3000, North Clybourn Avenue, Burbank, Calif. Chairman: Earl F. Slick Pres.: Thomas L. Grace Vice-Pres., Ops.: Henry P. Huff, Jr.	5 Douglas DC-6A 23 Curtiss Commando	—	—	—	Freight: 44,642,984 lb. 67,817,408 cargo ton-miles	Scheduled mail and freight services only. Fleet as at April 27, 1953. Has merged with The Flying Tiger Line, Inc.
Southern Airways, Inc.	Municipal Airport, Birmingham, Alabama Pres.: Frank W. Hulse Vice-Pres., Ops.: Hugh W. Davis	*10 Douglas DC-3	2,117*	3,382,349	121,065	189,875 ton-miles	*As at March 1, 1953.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
U.S.A.—*cont.*							
Southwest Airways	San Francisco Airport, P.O. Box 268, S. San Francisco, California Chairman: Leland Hayward Pres.: John H. Connelly Vice-Pres., Ops.: T. R. Mitchell	4 Martin 202 10 Douglas DC-3	1,153	2,757,535	164,281	Freight: 1,321,129 lb. Mail: 1,197,266 lb.	—
Trans-Texas Airways	Municipal Airport, Houston 17, Texas Pres.: R. E. McKaughan Vice-Pres., Ops: Henry E. Erdmann	10 Douglas DC-3	2,225	2,703,287	77,371	182,178 ton-miles	Fleet as at March 1, 1953.
Trans World Airlines, Inc.	10, Richards Road, Kansas City, Missouri Chairman: Warren Lee Pierson Pres.: Ralph S. Damon Vice-Pres., Ops.: John A. Collings	10 Lockheed Super Constellation 1049A 24 Lockheed Constellation 749A 12 Lockheed Constellation 749 32 Lockheed Constellation 049 40 Martin 4-0-4 12 Martin 2-0-2 13 Douglas DC-4 12 Douglas DC-3	33,000	71,247,000	2,573,000	Freight: 29,615,000 ton-miles Mail: 16,996,000 ton-miles	—
United Air Lines, Inc.	5959, South Cicero Avenue, Chicago 38, Illinois Pres.: W. A. Patterson Exec. Vice-Pres.: Otis E. Kline Vice-Pres., Ops.: D. R. Petty	6 Boeing Stratocruiser 19 Douglas DC-6B 43 Douglas DC-6 23 Douglas DC-4 48 Douglas DC-3 31 Convair 340	13,250	74,820,000	3,448,000	59,363,000 ton-miles	—
U.S. Airlines, Inc.	500, Fifth Avenue, New York, 36, N.Y. Pres.: Fred A. Miller Vice-Pres., Ops.: Bill Taylor	7 Curtiss Commando	—	—	—	—	Operates daily New York - Miami freight services.
Veteran Airways, Inc.	State Airport, Westerly, R.I. Pres.: Robert E. Lyon Vice-Pres.: Willis L. Jones	1 Cessna T-50 6 various single-engine types	—	—	—	—	Scheduled intra-State services.
West Coast Airlines, Inc.	Boeing Field, Seattle 8, Washington Pres.: Nick Bez Vice-Pres.: H. A. Munter Ops. Man.: George Cooke	12 Douglas DC-3	2,343	18,335,000 rev. pass.-miles	113,470	1,733,061 ton-miles	Fleet as at April 17, 1953. Merged with Empire Air Lines, Inc. on August 4, 1952, retaining its own name.
Western Air Lines, Inc.	6060, Avion Drive, Los Angeles Airport, Los Angeles 45, California Pres.: Terrell C. Drinkwater Vice-Pres., Ops.: Stanley R. Shatto	5 Douglas DC-6B 5 Douglas DC-4 10 Douglas DC-3 10 Convair 240 *On order:* 4 Douglas DC-6B	5,016	12,631,000	774,079	Freight and Express: 7,458,000 lb. Mail: 6,486,000 lb.	—
E. W. Wiggins Airways, Inc.	Norwood Municipal Airport, Norwood, Mass. Pres.: Joseph Garside Vice-Pres.: Harold E. Shaw Dir., Ops.: Harold E. Martin	5 Cessna T-50	486	313,944 rev. pass. miles	3,272	61 ton-miles	—
Wisconsin Central Airlines, Inc.	Municipal Airport, Madison, Wisconsin	—	—	—	—	—	Now re-named North Central Airlines, Inc. which see.
Wyoming Skyways, Inc.	Box 219, Cheyenne, Wyoming Pres.: Lyle R. Rosendahl Vice-Pres.: Clyde J. Bonham	2 Cessna 170 2 Cessna 120	—	—	—	—	Operates scheduled services within the State of Wyoming.
VENEZUELA							
Aerovias Venezolanas S.A. (Avensa)	Edificio Banco Unión, Chorro a Dr. Diaz, Caracas Pres.: Henry L. Boulton Pres. (Acting) and Gen. Man.: Andres Boulton Ops. Man.: Guillermo Ochoa Tucker	3 Douglas DC-4 19 Douglas DC-3 *On order:* 3 Convair 340 for delivery in 1953	3,491	4,805,279	252,843	16,188,687 lb.	Fleet as at March 10, 1953.

Airline	Head Office and Management	Fleet	Unduplicated Route Mileage	Total Miles Flown (1952)	Total Passengers Carried (1952)	Total Freight and Mail Carried (1952)	Remarks
VENEZUELA *cont.*							
Linea Aerea TACA de Venezuela C.A.	Conde a Carmelitas 13, Caracas Pres.: Rafael Arraiz Gen. Man.: Luis Paúl Ops. Man. (Nat'l. Div.): Antonio Maldinero Ops. Man. (Int'l. Div.): Manuel S. Mendoza	13 Douglas DC-3	4,000*	2,756,404	113,457	5,223,219 lb.	*As at March 1, 1953. A State-owned subsidiary of Linea Aeropostal Venezolana.
Linea Aeropostal Venezolana (L.A.V.)	Bloque 1, El Silencio, Caracas Pres.: Rafael Arraiz	4 Lockheed Constellation 2 Martin 202 22 Douglas DC-3 2 Curtiss Commando	14,320	6,495,810	207,004	23,814,000 lb.	State owned. Linea Aerea TACA de Venezuela is a wholly-owned subsidiary.
Rutas Aereas Nacionales S.A. (Ransa)	Edificio America, Caracas Man. Dir.: Carlos Chavez Ops. Man.: Keith F. Mitchell	8 Curtiss Commando 1 Douglas DC-3	—	—	—	—	—
YUGOSLAVIA							
Jugoslovenski Aero Transport (J.A.T.)	Bircaninova No. 1, P.O. Box 749, Belgrade 3 Gen. Man.: Vukovie Drago Ops. Man.: Andjelkovic Ratomir	20 Douglas DC-3 2 Short Sealand *On order:* 3 Convair 340	3,700	1,204,120	57,368	—	State-owned.

ALL THE WORLD'S AEROPLANES

(CORRECTED TO JULY 31, 1953.)

SOME FIRST FLIGHTS MADE DURING THE PERIOD JUNE 1, 1952—MAY 31, 1953

1952

June

4 KB.6 Matajur (Yugoslavia).
5 Max Plan PF.204 (France)
17 Avro Shackleton M.R. Mk. 2 (G.B.).
20 Iberavia I-115 (Spain).
21 Fouga Gemeaux V (France).
30 American Helicopter XH-26 (U.S.A.).

July

11 Farman Monitor I (France).
18 Dassault Mystère de Nuit (France).
19 Dassault M.D. 316 (France).
23 Fouga CM.170R Magister (France).
25 D.H. 110 (2nd prototype) (G.B.).
31 Sud-Est S.E.3120 Alouette helicopter (France).

August

5 Olympus-Canberra (G.B.).
10 McKinnie 175 (U.S.A.).
12 Short S.B.4/2 (2nd prototype) (G.B.).
16 Bristol Britannia (G.B.).
20 Vickers Viscount 701 (1st production) (G.B.).
21 Gloster Javelin (2nd prototype) (G.B.).
22 Saro Princess (G.B.).
25 Supermarine Swift F. Mk. 1 (1st production) (G.B.).
30 Avro 698 Vulcan (G.B.).

September

11 Hispano HA-43-D1 (1st production) (Spain).
15 Musca 1°Ter. (Italy).
25 Morane-Saulnier M.S. 733 (1st production) (France).
26 Dassault Mystère IV (France).
29 Nord 1104 (France).

October

2 Boeing XB-52 (U.S.A.).
7 Macchi M.B. 323 (Italy).
11 Avro Canada CF-100 Mk. 3 (Canada).
11 Avro Canada CF-100 Mk. 4 (Canada).
14 Lockheed P2V-6 Neptune (U.S.A.).
16 Sud-Ouest S.O. 4050 Vautour (France).
23 Hughes XH-17 helicopter (U.S.A.).
23 Boulton Paul Sea Balliol T. Mk. 21 (G.B.).
24 Nord 2501 (1st production) (France).
25 Piaggio P.150 (Italy).
28 Douglas XA3D-1 (U.S.A.).
30 First Short-built Canberra (G.B.).
31 Sud-Est Sea Venom (France).
31 Gloster Atar-Meteor (G.B.-France).

November

3 SAAB-32 Lansen (Sweden).
5 Cessna L-19B (U.S.A.).
11 Matra-Cantinieau MC-101 helicopter (France).

November (*cont'd*)

12 First Westland-built S-55 helicopter (G.B.).
12 Lockheed R7V-1 (U.S.A.).
17 Max Holste 1521 Broussard (France).
20 Percival Pembroke (G.B.).
25 First Avro-built Canberra (G.B.).
30 Hawker Hunter Mk. 2 (G.B.).

December

2 Short S.B.5 (G.B.).
4 Grumman XS2F-1 (U.S.A.).
4 Nardi FN.333 (Italy).
12 First Douglas-built B-47 (U.S.A.).
14 D.H. Heron Series 2 (G.B.).
16 First Lockheed-built B-47 (U.S.A.).
24 Handley Page H.P. 80 Victor (G.B.).
29 Dassault Mystère II (Atar 101C) (France).

1953

January

2 Sud-Ouest S.O. 1220 Djinn helicopter (France).
3 Cessna 310 (U.S.A.).
5 Ambrosini Sagittario (Italy).
16 Bristol Type 170 Mk. 32 (G.B.).
17 S.F.E.C.M.A.S. Ars. 1301 (air launch) (France).
24 Percival Provost (1st production) (G.B.).
27 Hurel-Dubois H.D. 31 (France).
27 Sud-Ouest S.O. 30-Atar (France).
29 Morane-Saulnier M.S. 755 Fleuret (France).

February

3 Fouga CM.170R Magister (2nd prototype) (France).
17 Lockheed 1049C Super-Constellation (1st production) (U.S.A.).
19 North American AJ-2 Savage (U.S.A.).
20 Avro 707A (2nd prototype) (G.B.).

March

2 Sud-Ouest S.O. 9000 Trident (France).
4 Bell XHSL-1 helicopter (U.S.A.).
7 Gloster Javelin (3rd prototype) (G.B.).
25 Brochet M.B. 100 (1st production) (France).

April

7 Okamura N-52 (Japan).
9 Convair XF2Y-1 Sea Dart (U.S.A.).
14 McDonnell XF-88B (U.S.A.).
27 Doman YH-31 helicopter (U.S.A.).
30 Grumman S2F-1 (1st production) (U.S.A.).

May

9 Sud-Ouest S.O. 3120 Farfadet Gyroplane (France).
11 North American F-86H Sabre (U.S.A.).
15 Hawker Hunter F. Mk. 1 (1st production) (G.B.).
16 Leduc O.21 (air launch) (France).
18 Douglas DC-7 (U.S.A.).
19 Grumman XF10F-1 (U.S.A.).
21 Morane-Saulnier M.S. 735 (France).
25 North American YF-100 (U.S.A.).
27 Supermarine Swift F.Mk.4 (G.B.).
29 Australian-built Canberra B. Mk. 20 (Australia).

THE ARGENTINE REPUBLIC

I.A.M.E.



The I.A.M.E. 33 Pulqúi II Single-seat Fighter (Rolls-Royce Nene engine).

EMPRESA INDUSTRIAS AERONAUTICAS Y MECCANICAS DEL ESTADO (I.A.M.E.).
CORDOBA.

Director-General: Brigadier Alberto N. Ferro Cessarego.

The Empresa Industrias Aeronauticas y Meccanicas del Estado (I.A.M.E.) was formed in 1952 to take over and control all State activities concerned with the design and construction of aircraft, engines, accessories, equipment and materials, both military and civil, used in the Republic.

The administration of the I.A.M.E. is undertaken by a Board of Directors presided over by the Minister of Aeronautics.

The Empresa Industrias Aeronauticas y Meccanicas del Estado took over the former Instituto Aerotecnico which could trace its origins back to 1927 when a Fabrica Militar de Aviones was established at Cordoba. The Instituto Aerotecnico had built aircraft of its own design since 1932.

The most notable products of the Instituto Aerotecnico were the I.Ae. 27 Pulqúi I, the first jet-propelled aircraft to be designed, built and flown in Latin America; and the I.Ae. 33 Pulqúi II, the first Latin American swept-wing jet fighter. The former flew for the first time on August 9, 1947, and the latter on June 27, 1950.

The Pulqúi II, which incorporates the latest developments in the field of high-speed aerodynamics, was designed by Prof. Dipl. Ing. Kurt Tank, former technical director of the German Focke-Wulf concern. Professor Tank is now domiciled in the Province of Cordoba and is acting as technical advisor to the I.A.M.E.

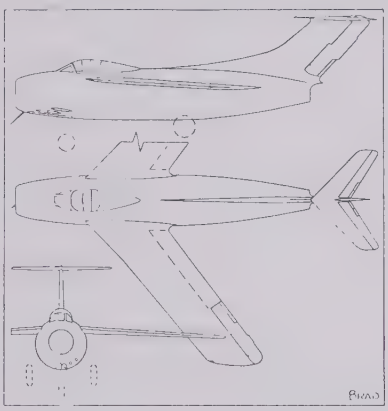
A more powerful all-weather version of the Pulqúi II is understood to be under development.

The earlier products of the Instituto Aerotecnico have been fully illustrated and described in previous editions of "All the World's Aircraft."

THE I.A.M.E. 33 PULQÚI (ARROW) II.

TYPE.—Single-seat Jet-propelled Fighter.

WINGS.—High mid-wing cantilever monoplane with 40° sweepback. All-metal stressed-skin structure. All-metal stressed-skin ailerons have hydraulic boost and leading-edge balance. Flaps inboard of ailerons. Gross wing area 25.1 m.² (270 sq. ft.).



The I.A.M.E. 33 Pulqúi II.

FUSELAGE.—Circular section all-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type with adjustable tailplane mounted on top of fin. Fin and rudder sweepback 50°, tailplane sweepback 45°. Metal-covered control surfaces, all statically and aerodynamically balanced and fitted with trim-tabs.

LANDING GEAR.—Retractable tricycle type. Air-oil shock-absorbers. Main wheels raised inwardly into fuselage, nose-wheel forward into fuselage nose. Hydraulic retraction. Steerable nose-wheel with non-shimmy shock-absorber. Brakes on all wheels.

POWER PLANT.—One Rolls-Royce Nene 2 centrifugal-flow turbojet engine in rear fuselage with nose air-entry and tail jet exit. Fuel tanks in fuselage (1,250 litres = 275 Imp. gallons) and wings (800 litres = 176 Imp. gallons).

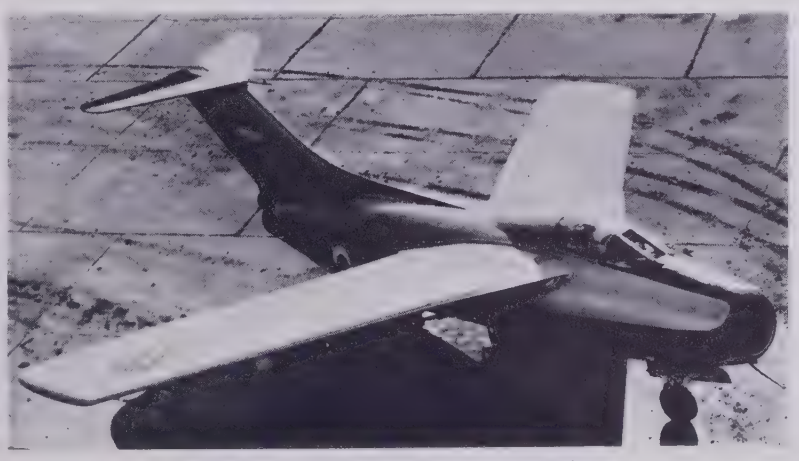
ACCOMMODATION.—Pressurised cockpit with sliding and jettisonable canopy. Pilot armour and bullet-resisting windscreen. Ejection seat. Automatic pilot.

ARMAMENT.—Four 20 mm. cannon in fuselage nose. Gyro gun-sight.

DIMENSIONS.—
Span 10.60 m. (34 ft. 9 in.).
Length 11.60 m. (38 ft. 0 in.).
Height (over tail) 3.30 m. (10 ft. 10 in.).

WEIGHTS (Designed).—
Empty 3,600 kg. (7,920 lb.).
Military load 1,950 kg. (4,290 lb.).
Loaded 5,550 kg. (12,210 lb.).

PERFORMANCE (Estimated).—
Max. speed at 5,000 m. (16,400 ft.) 1,040 km.h. (646 m.p.h.).
Rate of climb at S/L 1,790 m./min. (5,870 ft./min.).
Climb to 10,000 m. (32,800 ft.) 8.2 min.
Absolute ceiling 15,100 m. (49,530 ft.).
Landing speed (at 4,000 kg. = 8,800 lb.) 177 km.h. (110 m.p.h.).



The I.A.M.E. 33 Pulqúi II Swept-wing Fighter.

BELGIUM

AVIONS FAIREY

AVIONS FAIREY S.A.

HEAD OFFICE, WORKS AND AERODROME: GOSSELIES, NEAR CHARLEROI.

Managing Director: Mr. E. O. Tips, A.F.R.Ae.S., C.O.C.

The Belgian company was formed in 1933 as a subsidiary of the English Fairey Aviation Co., Ltd. The factory suffered considerable damage due to the bombing on May 10, 1940. Rebuilt after the liberation, the factory is now once again in working order and its activities cover the design and manufacture of aircraft and the repair and overhaul of aircraft for the Belgian military and civil authorities.

Mr. E. O. Tips, designed and built in 1935, a light single-seat touring monoplane known as the Tipsy "S". This machine and the two-seat version which followed met with considerable success and licences for their construction were acquired in England, France, Spain and South Africa.

The two-seater version was revived after the war under the name of Belfair, and a new single-seater, the Tipsy Junior, was produced. Between 1946 and 1948 seven Belfair and two Juniors were built. The Junior is now being redesigned around the 65 h.p. Continental engine; an enclosed cockpit may be fitted.

Avions Fairey is developing a new single-seat ultra-light monoplane to be known as the Nipper. It will be powered by a 25 h.p. Volkswagen engine.

The company is now engaged in the assembly of Gloster Meteor 8 fighters for the Belgian Government from aircraft components and sub-assemblies supplied by the Dutch Fokker and British Gloster companies, and Derwent engines built under licence in Belgium by the F.N. company.

SABCA

SOCIÉTÉ ANONYME BELGE DE CONSTRUCTIONS AÉRONAUTIQUES.

HEAD OFFICE AND WORKS: 1,470 CHAUSÉE DE HAECHT, HAREN, BRUSSELS.

The Société Anonyme Belge de Constructions Aéronautiques was, before the late war, the largest aircraft works in Belgium and in addition to building aircraft and aero-engines under licence for the Belgian Government and the S.A.B.E.N.A. company, it also designed and built aircraft of original design.

Throughout the war the company's factory was occupied by the enemy. It was seriously damaged in Allied bombing attacks and most of its machinery and equipment were dispersed.

Repair and re-equipment of the plant have now been completed and aeronautical activities have been resumed.

Apart from undertaking the study of certain aircraft design projects, the company is engaged in the assembly, maintenance and repair of Republic F-84E fighter aircraft.

SABCA now has special facilities for the manufacture of landing-gears, hydraulic systems and fuel systems.

BRAZIL

FOKKER

FOKKER INDUSTRIA AERONAUTICA S.A. do BRAZIL.

HEAD OFFICE AND WORKS: RIO DE JANEIRO.

This is a new company which has been formed with the assistance of the Brazilian Government. It is occupying the former Government factory on the Ihla do Governador in return for a small annual payment. The Dutch Fokker company has a 50 per cent. financial interest in the Brazilian company, which holds production licences for the S.11, S.12 and S.14 trainers which will be built for the Brazilian Government. The parent company will provide all tooling equipment for trainer production and at the outset will supply component parts for assembly by the Brazilian company until such time as local production gets under way.

I.P.T.

INSTITUTO DE PESQUISAS TECHOLOGICAS (Institute of Technical Research).

HEAD OFFICE: PRAÇA CEL. FERNANDO PRESTES, 110, CAIXA POSTAL 7141, SÃO PAULO.

Chief of the Scientific Department: Eng. Frederico Abranches Brotero.

Chief of the Aeronautical Section: Eng. Romeu Corsini.

This establishment, which is principally engaged in research, particularly with regard to the qualities of national materials suitable for use by the Brazilian Aircraft Industry, has designed and built a number of prototypes of light aircraft, sailplanes and gliders. These are mainly experimental prototypes and are not intended for commercial production. They employ materials and equipment of national origin, notably structural members, plywood and airscrews of indigenous timbers, the qualities of which are being investigated by the I.P.T.

The types I.P.T. 0 to I.P.T. 14 have been described in previous editions of "All the World's Aircraft." The latest designs are the I.P.T. 16 single-seat light cabin monoplane and the I.P.T. 17, a high-performance sailplane which will represent Brazil at the next International Sailplane Competition.

THE I.P.T. 16.

TYPE.—Single-seat Light Cabin monoplane.

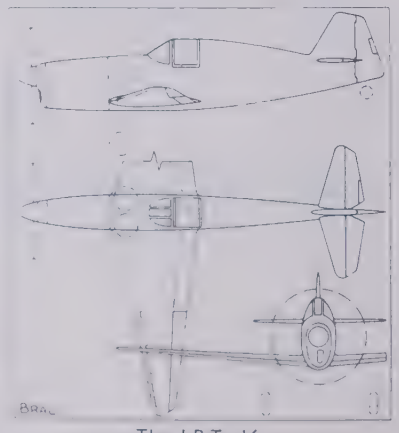
WINGS.—One-piece cantilever low-wing monoplane. Aspect ratio 7.4. Taper ratio 1 : 0.25. Two-spar wooden structure with plywood covering. Mechanically-operated split trailing-edge flaps between ailerons and fuselage Letterbox fixed slots in wings ahead of ailerons. Wing area 86.4 sq. ft. (8.0 m.²).

FUSELAGE.—Wooden monocoque structure with stressed plywood skin.

TAIL UNIT.—Cantilever monoplane type. Wooden structure with plywood covering on rudder and elevators. Controllable trim-tab in starboard elevator.

LANDING GEAR.—Retractable tail-wheel type. Each main wheel carried in half-fork on oleo-spring shock-absorber leg, retracted inwards under wing and fuselage and is contained in well projecting ahead of leading-edge. Mechanical operation. Hydraulic brakes. Non-retractable tail-wheel.

POWER PLANT.—One 160 h.p. inverted four-cylinder air-cooled engine driving a two-blade wooden airscrew. Fuel capacity 120 litres (26.4 Imp. gallons).



The I.P.T. 16.

DIMENSIONS.—
Span 7.7 m. (25 ft. 2 in.).
Length 7.0 m. (23 ft.).
Height 2.1 m. (6 ft. 11 in.).

WEIGHTS AND LOADINGS.—
Weight empty 440 kg. (970 lb.).
Disposable weight 200 kg. (440 lb.).
Weight loaded 640 kg. (1,410 lb.).
Wing loading 80.5 kg./m.² (16.5 lb./sq. ft.).
Power loading 4 kg./h.p. (8.8 lb./h.p.).

PERFORMANCE.—
Max. speed 340 km./h. (212 m.p.h.).
Cruising speed 300 km./h. (187 m.p.h.).
Stalling speed 90 km./h. (56 m.p.h.).
Endurance 3.5 hrs.
Range 1,050 km. (650 miles).

THE I.P.T. 17.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Cantilever monoplane. NACA 643-618 wing section. Aspect ratio 22. Chord 1.33 m. (4 ft. 4 in.) at root, 0.39 m. (1 ft. 4 in.) at tip. Dihedral 2° 30′. Incidence 4° 30′. All-wood monospar semi-monocoque structure with stressed plywood skin. All-wood Fowler type flaps. Differentially-controlled top-hinged all-wood ailerons. Area of flaps 2.0 m.² (21.5 sq. ft.). Area of ailerons 1.4 m.² (15 sq. ft.). Gross wing area 16.4 m.² (175 sq. ft.).

FUSELAGE.—All-wood monocoque structure with plywood skin. Width of fuselage 0.6 m. (2 ft.).

TAIL UNIT.—Cantilever monoplane type. Wood structure with plywood-covered fixed surfaces and fabric-covered elevators and rudder. Controllable trim-tab in starboard elevator. Areas: fin 0.186 m.² (2 sq. ft.), rudder 0.9 m.² (9.6 sq. ft.), tailplane 1.31 m.² (12.2 sq. ft.), elevators 0.79 m.² (8.5 sq. ft.). Tailplane span 3.2 m. (10 ft. 6 in.).

LANDING GEAR.—Permanent central skid.

Auxiliary detachable gear for take-off.
ACCOMMODATION.—Enclosed cockpit for pilot with moulded Plexiglas canopy conforming to lines of fuselage.
DIMENSIONS.—
Span 19 m. (62 ft. 6 in.).
Length 7.70 m. (25 ft.).
Height overall 1.44 m. (4 ft. 8 in.).
WEIGHTS (Designed).—
Weight empty 270 kg. (600 lb.).
Useful load 90 kg. (200 lb.).
Weight loaded 360 kg. (800 lb.).
PERFORMANCE (Estimated).—
Best gliding ratio 1 : 38 at 76 km.h. (47 m.p.h.).
Min. sinking speed 0.53 m./sec. (1 ft. 9 in./sec.) at 61 km.h. (38 m.p.h.).

MIGNET

AVIÕES MIGNET DO BRASIL.

HEAD OFFICE : RUA BARRA DO TIBAGÍ 485, SÃO PAULO.

Director : Henri Mignet.

Henri Mignet, whose controversial "Pou du Ciel," or "Flying Flea," created such wide interest in Europe in the early thirties has, since the war, endeavoured to establish himself in Latin America. After a sojourn in the Argentine Republic, he has now formed a company under the above name in Brazil to build his latest light aircraft, the H.M. 310.

In the "Pou du Ciel" Mignet aimed at extreme simplicity—simplicity of control and simplicity and cheapness of construction. He encouraged the amateur without excessive skill, special tools or previous flying experience, to build and fly his simplified aeroplane. His constructional books sold freely and at one time it was said that 400 copies of his "Pou du Ciel" were being built in France alone. Some fatal accidents, many mishaps and the ensuing condemnation of the untutored flying of uncertified aircraft of amateur construction, resulted in the ultimate failure of his movement in Europe, even though there were many who applauded his enthusiasm and his aim to bring flying within the reach of the greatest possible number of enthusiasts.

Briefly, the Mignet formula calls for the division of lift between two surfaces, in the form of a tandem monoplane or heavily-staggered biplane with slot effect ; the direct control of lift by movement of the front surface (the rear surface being fixed) ; the elimination of ailerons and elevators ; and the linking of the front wing and rudder controls to the single control column. All these features, with certain refinements, are to be found in this latest aircraft, the H.M. 310, which has been flying in prototype form since 1951. It is this model which he is now putting into production in Brazil.



The Mignet H.M. 310 Estafette (90 h.p. Continental A90 engine).

THE MIGNET H.M. 310 ESTAFETTE.

TYPE.—Two-seat Light Aircraft.
WINGS.—Consist of two surfaces of unequal span so positioned as to provide a slot or gap effect between the trailing-edge of the forward wing and the leading-edge of the rear wing. Forward wing has variable incidence controllable by direct connection with control column. Rear wing is fixed but provided with trailing-edge trimming surface of 0.67 m.² (7.2 sq. ft.) area. NACA 23012 wing section for both surfaces. Chord of both surfaces 1.40 m. (4 ft. 7 in.). Single-spar structures of wood with fabric covering. Outer sections of both wings hinged to fold up for storage. Gross wing area 15.94 m.² (171.5 sq. ft.).
FUSELAGE.—Welded steel-tube structure with fabric covering.
TAIL UNIT.—Vertical rudder only. Area : 0.745 m.² (8 sq. ft.).
LANDING GEAR.—Fixed tail-wheel type. Rubber cord springing. Goodyear wheels and hydraulic brakes. Steerable tail-wheel. Track : 1.80 m. (5 ft. 11 in.).
POWER PLANT.—One 90 h.p. Continental A90-12F four-cylinder horizontally-opposed air-cooled engine. Sensenich two-blade airscrew. Two fuel tanks in fuselage. Total fuel capacity 140 litres (31 Imp. gallons).
ACCOMMODATION.— Enclosed cockpit seating two side-by-side
DIMENSIONS.—
Span of front wing 7.0 m. (22 ft. 11½ in.).
Span of rear wing 5.54 m. (18 ft. 2 in.).
Overall length 4.52 m. (14 ft. 10 in.).
Overall height 2.05 m. (6 ft. 8½ in.).
Width folded 4.00 m. (13 ft. 1½ in.).
WEIGHT.—
Weight empty 300 kg. (660 lb.).
PERFORMANCE.—
Cruising speed 180 km.h. (112 m.p.h.).
Landing speed 45 km.h. (28 m.p.h.).

NEIVA

PLANADORES NEIVA.

HEAD OFFICE AND WORKS : CAMPO DE NANGUINHOS, RIO DE JANEIRO.

Director : J. C. Barros Neiva.

This concern is supplying Neiva B-2 Monitor two-seat sailplanes for use in the Brazilian Government's gliding schools programme.

THE NEIVA B-2 MONITOR.

TYPE.—Two-seat medium-performance Sailplane.
WINGS.—Braced high-wing monoplane. Wing section Goettingen 535. Aspect ratio 13.67. Mean chord 1.343 m. (4 ft. 4⅞ in.). Dihedral 0° 30′. Incidence (at root) 3°. Single box-spar with plywood-covered torsion-resistant leading-edge. Fabric-covering aft of spar. Normal type wood-framed fabric-covered ailerons. Wood spoiler type flaps. Areas : spoiler flaps 0.315 m.² (3.38 sq. ft.), ailerons (2) 3.124 m.² (33.61 sq. ft.). Gross wing area 18.40 m.² (198 sq. ft.).
FUSELAGE.—Semi-monocoque all-wood structure with steel-tube frames to support wing attachments and struts.
TAIL UNIT.—Cantilever monoplane type. Wood framework with fabric covering. Areas : fin 0.30 m.² (3.23 sq. ft.), rudder 1.32 m.² (14.20 sq. ft.), tailplane 1.30 m.² (13.98 sq. ft.), elevators 3.00 m.² (32.28 sq. ft.). Tailplane span 3.32 m. (10 ft. 11½ in.).



The Neiva B-2 Monitor Two-seat Sailplane.

LANDING GEAR.—Front skid and single Goodyear wheel aft of C.G.
ACCOMMODATION.—Open cockpit seating two in tandem. Luggage compartment between pilots. Can be flown solo from front seat only.
DIMENSIONS.—
Span 15.86 m. (52 ft.).
Length 7.10 m. (23 ft. 3½ in.).
Height 1.13 m. (3 ft. 9 in.).
WEIGHTS AND LOADINGS.—
Weight empty 210 kg. (462 lb.).
Disposable load 150 kg. (330 lb.).
Weight loaded 360 kg. (792 lb.).
Wing loading 19.5 kg./m.² (3.99 lb./sq. ft.).
PERFORMANCE.—
Stalling speed 52 km.h. (32.3 m.p.h.).
Best gliding speed 67 km.h. (41.6 m.p.h.).
Max. safe speed 145 km.h. (90 m.p.h.).
Best gliding ratio 1 : 21.

THE BRITISH COMMONWEALTH
GREAT BRITAIN

AIRSPEED



The Airspeed Ambassador Airliner (two 2,600 h.p. Bristol Centaurus 661 engines).

AIRSPEED DIVISION OF THE DE HAVILLAND AIRCRAFT CO., LTD.

HEAD OFFICE: HATFIELD, HERTS.

WORKS: CHRISTCHURCH AND PORTSMOUTH, HANTS.

Directors: see The de Havilland Aircraft Co., Ltd.

General Manager, Christchurch Works: Hereward de Havilland, D.S.O.

General Manager, Portsmouth Works: J. Liddell.

In 1951 Airspeed, Ltd. was merged with the de Havilland Aircraft Co., Ltd. and now operates as the Airspeed Division of the parent company.

Airspeed was responsible for the design and production of the Ambassador, twenty-one of which were built for British European Airways, the first going into scheduled airline service in March, 1952.

The Airspeed Division was also responsible for the design and development of the D.H. 115 Vampire Trainer (described under "de Havilland"), which is now in production for eleven air forces.

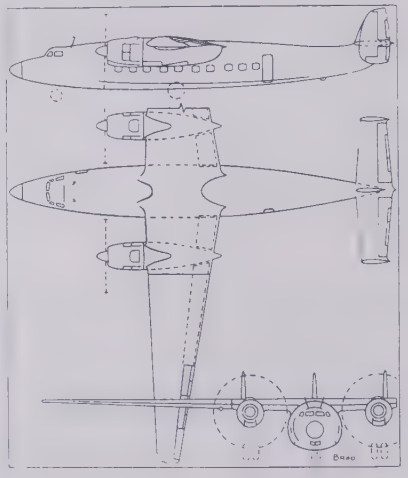
THE AIRSPEED A.S.57 AMBASSADOR.

TYPE.—Twin-engined Medium-range Airliner.

WINGS.—Cantilever high-wing monoplane. Laminar-flow aerofoil; reflexed NACA 652415 section. Aspect ratio 11. Dihedral (under surface) 1° 22′. Two-spar structure with heavy-gauge metal skin. Thermal de-icing system. Metal-framed aerodynamically balanced ailerons, with shrouded leading-edges and fabric covering. All-metal split trailing-edge flaps. Hydraulic operation. Total aileron area: 74 sq. ft. (6.86 m.²). Total flap area: 164 sq. ft. (30.4 m.²). Gross wing area: 1,200 sq. ft. (111 m.²).

FUSELAGE. All-metal structure with cross section of two intersecting circles. Maximum external width 11 ft. 5 in. (3.48 m.).

TAIL UNIT.—Cantilever structure with twin fins and rudders at extremities of tailplane, and third fin over fuselage centre-line. Horizontal aerofoil section EC 1540. Fin and rudder aerofoil section, NACA 0012.5. All-metal structure with metal skin over fins, tailplane and rudders, and fabric-covered elevators. Outer rudders have horn-balanced portions at top and bottom, which contain mass-balances. All fins detachable and outer fins interchangeable.



The Airspeed A.S.57 Ambassador.

Pre-loaded spring tabs on outer rudders; differentially geared tabs on elevator. Tailplane span, 30 ft. 6 in. (9.3 m.); incidence 1 degree; total horizontal area 199 sq. ft. (18.5 m.²); centre fin area, 40 sq. ft. (3.72 m.²); outer fin area (each) 59 sq. ft. (5.47 m.²).

LANDING GEAR.—Retractable tricycle type of mainly Airspeed design. Twin main wheels on common axle on single shock-absorber strut retract forward into engine nacelle. Steerable nose unit comprises twin wheels on single leg which retracts forward into fuselage. Complete gear raised by hydraulic (power-pack and accumulator) operation and lowered by gravity and air-drag forces. Each main wheel has a Dunlop disc-type brake operated hydraulically from main system. Emergency bumper wheel and oleo leg in rear fuselage. Track 27 ft. 6 in. (8.4 m.); wheelbase 24 ft. 6 in. (7.4 m.).

POWER PLANT.—Two Bristol Centaurus 661 eighteen-cylinder two-row sleeve-valve radial air-cooled engines enclosed in Airspeed low-drag cowlings and mounted as interchangeable power-eggs. Each engine rated at 2,600 h.p. for take-off, 2,320 h.p. at 5,000 ft. (1,525 m.) METO power, and 1,750 h.p. at 13,300 ft. (4,050 m.) max. weak mixture cruising power. D.H. four-blade full-feathering reversible-pitch airscrews 16 ft. (4.88 m.) diameter. Integral fuel tanks in outer wings, each with capacity of 500 Imp. gallons (2,273 litres). Provision for two additional bag tanks of 300 Imp. gallons (1,364 litres) capacity each. Oil capacity 28 Imp. gallons (127 litres) per engine.

ACCOMMODATION.—Pressurised accommodation. Crew compartment forward with pilot and co-pilot side-by-side with dual controls. Wireless operator immediately behind pilot. Crew entry door forward on starboard side. Main cabin 32 ft. 5 in. long × 10 ft. 6 in. wide × 6 ft. 4½ in. high (9.9 m. × 3.2 m. × 1.9 m.) has volume of 2,168 cub. ft. (61.4 m.³). Cabin may seat up to forty-seven passengers. Main entry door on port side aft of cabin 3 ft. 6 in. (1.07 m.) from ground, with built-in stowable staircase. Two toilet compartments each of 94 cub. ft. (2.6 m.³) capacity, and cloak-room of 30 cub. ft. (0.85 m.³) capacity at rear. Baggage and freight compartments in nose (15 cub. ft. = 0.42 m.³) and aft (145 cub. ft. = 4.1 m.³). Hand luggage compartment (173 cub. ft. = 4.9 m.³) on port side between crew quarters and main cabin, and galley (220 cub. ft. = 6.22 m.³) on starboard.

DIMENSIONS.—
Span 115 ft. 0 in. (35 m.).
Length 82 ft. (25.0 m.).
Height (on ground over rudders) 18 ft. 3 in. (5.55 m.).

WEIGHTS AND LOADINGS (Forty-seat version)
Operator's empty weight 35,781 lb. (16,230 km.).
Weight loaded 52,500 lb. (23,814 kg.).
Max. payload 11,645 lb. (5,280 kg.).
Wing loading 43.3 lb./sq. ft. (211.5 kg./m.²).
Power loading 10 lb./b.h.p. (4.47 kg./b.h.p.).

PERFORMANCE.—
Recommended fast cruising speed (65% METO power) 272 m.p.h. (438 km.h.).
Most economical speed (45% METO power) 248 m.p.h. (400 km.h.).
Initial rate of climb (normal) 1,225 ft./min. (6.23 m./sec.).
Initial rate of climb (single engine) 410 ft./min. (2.08 m./sec.).
Stage distance with full tanks and 8,000 lb. (3,630 kg.) payload at 40% METO power at 10,000 ft. (3,050 m.) 1,200 miles (1,930 km.).
Runway length for I.C.A.O. compliance at max. all-up weight 1,530 yds. (1,400 m.).



The Armstrong Whitworth Meteor N.F.Mk.11 two-seat Night Fighter (two Rolls-Royce Derwent turbojet engines).

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT, LTD.

HEAD OFFICE: BAGINTON, NR. COVENTRY.

WORKS AND AERODROME: BAGINTON AND WHITLEY, COVENTRY.

Directors: Sir Frank Spencer Spriggs, K.B.E., Hon. F.R.Ae.S. (Chairman), Sir Thomas O. M. Sopwith, C.B.E., Hon. F.R.Ae.S., H. M. Woodhams, C.B.E., F.R.Ae.S., (Managing Director) J. Lloyd, F.R.Ae.S. (Technical Director), W. S. D. Lockwood, O.B.E., A.F.R.Ae.S. (Works Director), C. S. Emery (Sales Director).

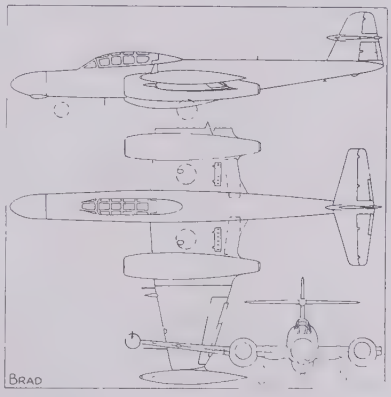
Chief Designer: H. R. Watson.

Secretary: F. D. Stallabrass.

Sir W. G. Armstrong Whitworth Aircraft, Ltd., was formed in 1921. In 1935, the Hawker-Siddeley Group was formed to amalgamate the interests of Hawker Aircraft Ltd., and the Armstrong Siddeley Development Co., Ltd., which latter company controlled Sir W. G. Armstrong Whitworth Aircraft, Ltd., Armstrong Siddeley Motors, Ltd., and A. V. Roe & Co., Ltd.

The policy of the Company has, in the main, been based upon the development of the large type of aircraft, orthodox and unorthodox, for both civil and military purposes. The unorthodox have included the A.W.52 jet-propelled flying-wing and A.W.52G flying-wing glider.

Another notable post-war product was the A.W.55 Apollo, a civil airliner powered by four Armstrong Siddeley Mamba turboprop engines. The Apollo, which received its Certificate of Airworthiness in 1950, has been fully illustrated and described in previous editions of "All the World's Aircraft."



The Armstrong Whitworth Meteor N.F.Mk.11.

During 1949, the company was entrusted with the development of a night fighter version of the Gloster Meteor. All the necessary design work was done by Armstrong Whitworth, who also undertook the construction of the two prototypes, designated Meteor N.F. Mk. 11. The first of these made its first flight on May 31, 1950.

The N.F. 11 was adopted as a standard night fighter and was ordered into production for the Royal Air Force. It has also been supplied to several European countries, including Belgium, Denmark and France

Production of the Hawker Sea Hawk for the Royal Navy is also being undertaken by Armstrong Whitworth.

THE ARMSTRONG WHITWORTH METEOR NIGHT FIGHTER

The design and production of the Meteor two-seat night fighter has been and still is the responsibility of Armstrong Whitworth.

The adaptation of the Meteor airframe to meet a night fighter specification has resulted in the production of a completely new aeroplane which, however, still retains most of the external characteristics of the Gloster Meteor.

Recognitionally, the night fighter has a long fuselage with extended nose housing the A.I. radar; Mk. 7 type cockpit arrangement and side-hingeing canopy; Mk. 3 type long-span outer wings; and Mk. 8 type tail-unit. Because the fuselage nose is fully occupied by radar equipment, the armament of four 20 mm. cannon is wing-mounted in pairs outboard of the engine nacelles.

The first production version was the N.F. Mk. 11. Subsequent versions include the N.F. Mk. 12 with improved radar, revised canopy, etc.; the N.F. Mk. 13, which is the Mk. 11 equipped for service outside the United Kingdom; and the N.F. Mk. 14, which is similar to the Mk. 13 but with the improvements first incorporated in the Mk. 12.

At the time of writing no further details of the Meteor night fighter were available for publication.

AUSTER

AUSTER AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: REARSBY AERODROME, REARSBY, LEICESTER.

Directors: F. Bates (Managing Director), P. Wykes (Chairman), A. J. Pickering, K. Sharp, F. A. Pratley, F.C.A.

Chief Designer: R. E. Bird.

Auster Aircraft, Ltd. was formed in 1939 to manufacture light aircraft and assumed its present title on March 7, 1946. Throughout the last war many military A.O.P. aircraft were built, which led to the successful series of post-war civil aircraft.

In the military field the Auster A.O.P. Mk. 6 and T. Mk. 7 are still in production.

The Auster Model "S" has served as a prototype for the Auster A.O.P. Mk. 9, a completely new type of A.O.P. which is now in production. The first Mk. 9 was expected to fly late in 1953.

The Auster Ambulance/Freighter, a unique type of light freighter with both



Three Auster A.O.P. Mk. 6 Monoplanes (145 h.p. D.H. Gipsy Major 7 engines).

civil and military applications has been the subject of an extensive development programme.

Current civil Auster aircraft include the Autocrat, J.5, Aiglet, Aiglet Trainer and the Autocar, the various versions of which are described hereafter.

All three- or four-seat civil Austers can be fitted with equipment for crop-dusting and spraying, cable-laying, glider-towing, banner-towing, air-to-ground broadcasting, aerial photography and air ambulance duties. Skis and cross-wind landing wheels are also approved for fitment to all Austers, and those types with engines of 130 h.p. or more can be fitted with floats. All three-seaters can have a double rear seat fitted to convert them into occasional four-seaters.

THE AUSTER A.O.P. SERIES.

Since the war versions of the Auster Observation Post monoplanes have continued in production for Army Co-operation use. The current versions are as follow :—

Auster A.O.P. Mk. 6. 145 h.p. D.H. Gipsy Major 7 engine. Developed from the Mk. 5. Modified fuselage and increased all-up weight. All-metal auxiliary aerofoil flaps below and behind trailing-edge, and wings have been strengthened to take two 11.5 Imp. gallon (52.25 litre) fuel tanks, giving a total capacity of 23 Imp. gallons (104.5 litres). Pilot and observer seated in tandem, the latter in a swivel chair. Radio receiver/transmitter is beside pilot's seat. Lengthened landing-gear struts to allow for larger airscrew. Initial production completed in 1949 but further production began early in 1952.

Auster T. Mk. 7. Two-seat trainer quickly convertible (15 minutes) to full A.O.P. standard. Similar in construction, dimensions and external appearance to Mk. 6. Side-by-side seating with full dual control. Floor of rear of cabin strengthened to permit installation of third seat if required, and ample space is available in rear cabin for fitting of F-24 camera, cable-laying equipment, etc. Two-stage screening provided for simulated instrument and night-flying training.

Auster A.O.P. Mk. 9. 180 h.p. Cirrus Bombardier 203 (military version of 702) engine. Development of Model S (which see). In production.

The specification which follows refers to the A.O.P. Mk. 6.

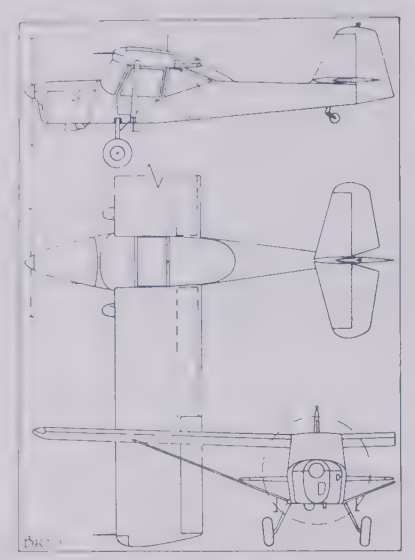
DIMENSIONS.-
- Span 36 ft. 0 in. (11.0 m.).
- Length 23 ft. 9 in. (7.23 m.).
- Height 8 ft. 4½ in. (2.55 m.).
- Wing area (excluding flaps) 184 sq. ft. (17.1 m.²).

WEIGHTS AND LOADINGS (Mk. 7)·—
- Tare weight 1,469 lb. (666,2 (kg.).
- Removable equipment 50 lb. (22.7 kg.).
- Crew and parachutes 400 lb. (181.3 kg.).
- Inter-comm. amplifier 10 lb. (4.5 kg.).
- Fuel and oil 193 lb. (87.5 kg.).
- All-up weight 2,122 lb. (962 kg.).

PERFORMANCE (Mk. 7).—
- Max. speed 122 m.p.h. (195.2 km.h.).
- Cruising speed 107 m.p.h. (171.2 km.h.).



The Auster T. Mk. 7 Trainer (145 h.p. D.H. Gipsy Major 7 engine).



The Auster A.O.P. Mk. 9.

- Stalling speed (with flaps) 34 m.p.h. (54.4 km.h.).
- Landing speed 38 m.p.h. (60.8 km.h.).
- Initial rate of climb 660 ft./min. (201 m./min.).
- Service ceiling 12,000 ft. (3,660 m.).
- Range (still air) 315 miles (504 km.).
- Take-off run (5 m.p.h.=8 km.h. wind) 125 yds. (114 m.).
- Landing run 90 yds. (82 m.).

THE AUSTER MODEL S.

The Model S was designed as a private venture to embody the experience gained with the operation of thousands of Auster A.O.P. aircraft.

The Model S is powered by a 180 h.p. Cirrus Bombardier 702 direct fuel-injection engine which drives a Fairey-Reed airscrew.

The structure is basically similar to that of the Auster Mk. 6 and 7. All steel structural components are shot-blasted and sprayed with aluminium to eliminate the possibility of corrosion.

The landing-gear is fitted with extra large main wheels and tyres and dual solid tyred tail-wheels for operation on soft or sandy ground.

The wings are fitted with split trailing-edge flaps and the tail-unit has larger horn-balanced rudder and elevators.

Provision is made for a bullet-proof fuel tank (16 Imp. gal.=72.5 litre) in the root of each wing, but normally the starboard tank is regarded as a long-range tank.

The Model S has been used as a development aircraft for the Auster A.O.P. Mk. 9 which is now in production.

DIMENSIONS.—
- Span 36 ft. (11.0 m.).
- Length 23 ft. 8½ in. (7.22 m.).
- Height 9 ft. 3 in. (2.82 m.).
- Wing area 184.5 sq. ft. (17.14 m.²).

WEIGHTS AND LOADINGS.—
- Weight loaded 2,025 lb. (918.5 kg.)
- Wing loading 10.95 lb./sq. ft. (53.42 kg./m.²).
- Power loading 11.25 lb./h.p. (4.77 kg./h.p.).

PERFORMANCE.—
- Max. speed 132 m.p.h. (211 km.h.).
- Cruising speed 117 m.p.h. (187 km.h.).
- Initial rate of climb 1,200 ft./min. (376 m./min.).
- Service ceiling 16,000 ft. (4,880 m.).
- Range 230 miles (370 km.).
- Take-off distance to 50 ft. (15.25 m.) 240 yds. (281 m.).
- Landing distance from 50 ft. (15.25 m.) 250 yds. (228 m.).

THE AUSTER B.4.

The B.4 was designed and built as a private venture to perform the numerous duties, other than that of A.O.P. itself, required of a light military aircraft. It features a large cabin with a loading door at its rear end. The basic floor provides fittings for seats, stretchers or light freight, but this floor is quickly removable and can be replaced by other floors incorporating equipment for other rôles, such as cable-laying, crop-dusting and spraying, air-to-ground broadcasting, etc.

The wings and engine-mounting are interchangeable between the B.4 and Model S already described.

TYPE.— Single-engined General Purpose monoplane.

WINGS.— High-wing rigidly-braced monoplane. Same as for Model S. Split trailing-edge flaps. Gross wing area 189.75 sq. ft. (17.7 m.²).

FUSELAGE.— Welded steel-tube structure covered with fabric. Forward portion is square, with a triangular wedge roof to which tail boom is bolted. Rear loading door of cabin is of wood.

TAIL UNIT.—Braced monoplane type. Port elevator has controllable trim-tab, rudder and adjustable tab.

LANDING GEAR.— Non-retractable four-wheel type. Main units incorporate Dowty liquid-spring shock-absorbers and Goodyear wheels and hydraulic brakes. The two rear, or tail, wheels also have liquid springs and are fully castoring. Main wheel track 6 ft. 11 in. (2.13 m.).

POWER PLANT.— One 180 h.p. Cirrus Bombardier 702 four-cylinder in-line inverted air-cooled engine driving a Fairey-Reed two-blade metal airscrew. Two bullet-proof fuel tanks, one in each wing root. Total fuel capacity 23 Imp. gallons (105 litres).

ACCOMMODATION.— Cabin may seat four. All seats except pilots (port front) removable.



The Auster Model S A.O.P. Monoplane (180 h.p. Cirrus Bombardier 702 engine).



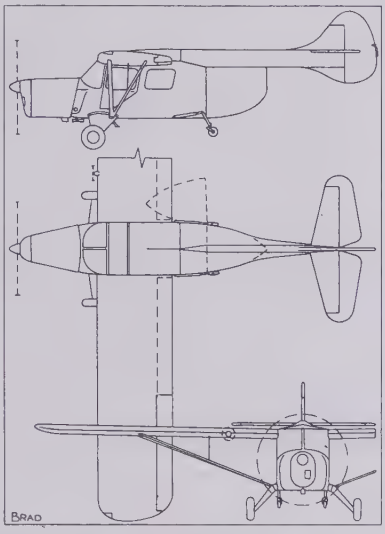
The Auster B.4 with its rear loading door removed

Bushes in floor serve as freight lashing and seat and stretcher attachment points. Two stretchers may be carried on starboard side, one above the other, with seat for attendant on port. Floor is secured by six bolts and may be quickly removed and replaced by others with special fittings or equipment attached. Rear loading door hinges to starboard to leave clear opening 30 in. × 38½ in. (93 cm. × 98 cm.). Volume of usable cabin space 110 cub. ft. (3.7 m.³).

DIMENSIONS.—
Span 37 ft. (11.25 m.).
Length 24 ft. 8 in. (7.53 m.).
Height 8 ft. 4½ in. (2.56 m.).

WEIGHTS.—
Weight empty 1,642 lb. (745 kg.).
Payload for max. range 550 lb. (250 kg.).
Weight loaded 2,600 lb. (1,180 kg.).

PERFORMANCE.—
Max. cruising speed 105 m.p.h. (169 km.h.).
Initial rate of climb 730 ft./min. (223 m./min.).
Range 300 miles (480 km.).
Take-off distance to 50 ft. (15.25 m.) (5 m.p.h. = 8 km.h. wind) 415 yds. (380 m.).
Landing distance from 50 ft. (15.25 m.) (5 m.p.h. = 8 km.h. wind) 255 yds (233 m.).



The Auster B.4 Light Transport



The Auster J.1 Autocrat (100 h.p. Cirrus Minor 2 engine).

THE AUSTER J.1 AUTOCRAT.

TYPE.—Three or four-seat Cabin monoplane.

WINGS.—Strut-braced high-wing monoplane. Incidence (root) 3¾ degrees (tip) 2⅓ degrees; dihedral 1 degree; chord 5 ft. 3 in. (1.60 m.). Wing braced by streamlined steel-tube V-struts on each side. Structure consists of laminated spruce spars, ribs of drawn-section light alloy, steel drag struts and tie-rod internal bracing, metal leading-edge and an overall fabric covering. Ailerons have wooden spars, light alloy nose and ribs and fabric covering. Manually-operated split trailing-edge flaps have steel torsion shaft and light alloy skin. Total aileron area 18 sq. ft. (1.66 m.²). Total flap area 16 sq. ft. (1.47 m.²). Gross wing area 185 sq. ft. (17.14 m.²).

FUSELAGE.—Rectangular-section welded steel-tube structure with fabric covering.

TAIL UNIT.—Braced monoplane type. Welded steel-tube framework with fabric covering. Fixed tailplane. Rudder has trim-tab adjustable on ground. Controllable trim-tab in port elevator. External tie-rod bracing. Tailplane span 10 ft. (3.05 m.). Gross tailplane area 24.72 sq. ft. (2.28 m.²); fin area 5 sq. ft. (0.37 m.²); rudder area 7.25 sq. ft. (0.67 m.²).

LANDING GEAR.—Fixed two-wheel type. Half-axles sprung under centre-line of fuselage by rubber-cord shock-absorbers. Dunlop wheels and Bendix brakes. Track 6 ft. 0 in. (1.83 m.). Full-castoring tail-wheel on leaf-spring with solid rubber tyre

POWER PLANT.—One 100 h.p. Blackburn Cirrus Minor 2 four-cylinder in-line inverted air-cooled engine. Weybridge wood or Fairey-Reed metal airscrew 6 ft. 0 in. (1.83 m.) diameter. Fuel tank between engine and dashboard with capacity of 15 Imp. gallons (68 litres). Auxiliary fuel tank of 13¾ Imp. gallons (62.5 litres) capacity may be carried under fuselage. Oil tank of 2 Imp. gallons (9 litres) capacity aft of engine.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls, and one aft on starboard side facing to port or two in rear of cabin facing forward. Backs of front seats hinge forward for access to rear. One-piece moulded Perspex windshield and moulded cabin roof. Access door on each side with sliding windows. Luggage space aft of rear seat with allowance of 300 lb. (136 kg.).

DIMENSIONS.—
Span 36 ft. 0 in. (11.0 m.).
Length 23 ft. 5 in. (7.14 m.).
Height (tail down, airscrew horizontal) 6 ft. 6 in. (1.98 m.)

WEIGHTS AND LOADINGS.—
Weight empty 1,052 lb. (477 kg.)
Fuel and oil 128 lb. (58 kg.).
Equipment 62 lb. (28 kg.).
Pilot, two passengers and luggage 608 lb. (277 kg.).
Weight loaded 1,850 lb. (840 kg.).
Wing loading (fully loaded) 10 lb./sq. ft (49 kg./m.²).
Power loading (fully loaded; take-off power) 18.5 lb./h.p. (8.5 kg./h.p.).

PERFORMANCE.—
Max. speed 120 m.p.h. (193 km.h.).
Cruising speed 100 m.p.h. (161 km.h.).
Stalling speed (with two up and flaps down) 28 m.p.h. (45 km.h.).
Rate of climb (at 1,700 lb. = 801 kg.) 568 ft./min. (180 m./min.).
Ceiling 15,000 ft. (4,750 m.).
Still-air range 320 miles (515 km.).
Still-air range with long-range tank 600 miles (985 km.).
Take-off run in 5 m.p.h. (8 km.h.) wind 150 yds. (137 m.).
Landing run in 5 m.p.h. (8 km.h.) wind 85 yds. (78 m.).
Fuel consumption at 2,300 r.p.m. 4.9 Imp. gallons (22.2 litres) per hr.
Fuel consumption at 2,200 r.p.m. 4.3 Imp. gallons (19.5 litres) per hr.

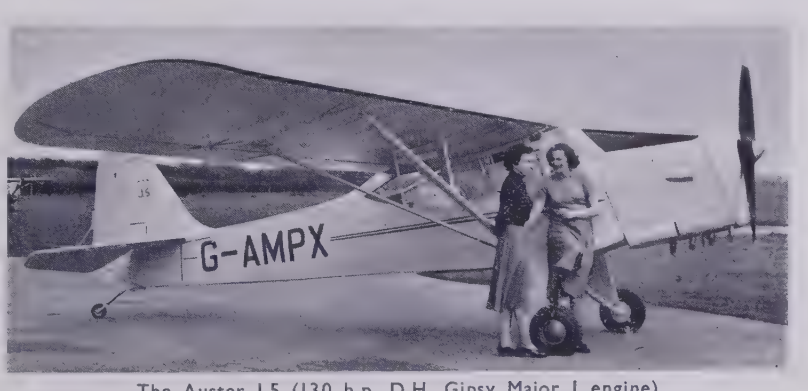
THE AUSTER J.5.

The J.5 is basically similar to the Autocrat but is fitted with the 130 h.p. Gipsy Major 1 engine and long-range tanks. It was originally produced for the Australian and New Zealand market, where the three-seat version is known as the Autocrat and the four-seat version as the Adventurer.

To meet New Zealand Government requirements, a floatplane version of the J.5 was produced and tested in 1951. Apart from having twin Auster floats, this version differs from the landplane in having the larger horn-balanced rudder as fitted to the Aiglet and also an underfin.

DIMENSIONS.—
Span 36 ft. (11.0 m.).
Length 23 ft. 0 in. (7.01 m.).
Height 8 ft. 8 in. (2.64 m.).
Wing area 185 sq. ft. (17.14 m.²).

WEIGHTS AND LOADINGS.—
Weight empty 1,162 lb. (526 kg.).
Weight loaded (landplane) 2,100 lb. (952 kg.).
Weight loaded (floatplane) 2,300 lb. (1,450 kg.).
Wing loading 11.35 lb./sq. ft. (44.39 kg./m.²).
Power loading 16 lb./h.p. (7.21 kg./h.p.).



The Auster J.5 (130 h.p. D.H. Gipsy Major 1 engine).

PERFORMANCE (landplane at 1,750 lb.=794 kg. loaded weight).—
Max. speed 114 m.p.h. (183 km.h.).
Cruising speed 101 m.p.h. (163 km.h.).
Stalling speed (flaps down) 29 m.p.h. (47 km.h.).
Rate of climb 637 ft./min. (194 m./min.).
Ceiling 12,500 ft. (3,810 m.).
Still air range 375 miles (603 km.).
Take-off run in 5 m.p.h. (8 km.h.) wind 140 yds. (128 m.).
Landing run in 5 m.p.h. (8 km.h.) wind 115 yds. (105 m.).
Fuel consumption at 2,000 r.p.m. 6.3 Imp. gallons (28.6 litres) per hour.

PERFORMANCE (seaplane at 2,300 lb. 1,450 kg. loaded weight).—
Max. speed 102 m.p.h. (164 km.h.).
Cruising speed 91 m.p.h. (147 km.h.).
Stalling speed (flaps down) 32 m.p.h. (51.5 km.h.).
Initial rate of climb 375 ft./min. (2 m./sec.).
Service ceiling 7,500 ft. (2,340 m.).
Take-off distance 490 yds. (460 m.).
Take-off time 48 seconds.
Landing run 150 yds. (140 m.).
Range 260 miles (420 km.).

THE AUSTER J.5F AIGLET TRAINER.

The Aiglet Trainer is a two-seat dual-control aerobatic training aircraft which has been designed to fulfil present-day training requirements and to provide maximum usage at lowest cost. The airframe is basically J.5 but the Aiglet Trainer has horn-balanced rudder and elevators and the wings have been clipped to 32 ft. (9.76 m.) to give a greater rate of roll. The side-by-side seats are designed to conform to the aircraft's aerobatic category and the fuselage width has been increased by 4 in. (10.16 cm.) to give a wider cabin.

The J.5F can also be supplied as a three-seat tourer, in which case the aerobatic seats are replaced by standard Auster front seats. The seat for the rear passenger is of the wide forward-facing type.

A 16 Imp. gallon (72.5 litre) fuel tank is provided in the starboard wing root and provision is made for another of similar capacity (long-range) in the port wing.

The Aiglet Trainer is fitted with a 130 h.p. D.H. Gipsy Major 1 engine which drives a Fairey-Reed two-blade metal airscrew.

DIMENSIONS.-
Span 32 ft. (9.76 m.).
Length 23 ft. 2½ in. (7.07 m.).
Height 8 ft. 3 in. (2.52 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,323 lb. (601 kg.).
Weight loaded (Aerobatic two-seater) 1,950 lb. (885 kg.).



The Auster Aiglet Trainer as supplied to the Royal Pakistan Air Force.

Weight loaded (three-seat Tourer) 2,200 lb. (1,000 kg.).
Wing loading 13.45 lb./sq. ft. (65.63 kg./m.²).
Power loading 16.9 lb./h.p. (7.67 kg./h.p.).

PERFORMANCE.-
Max. speed 127 m.p.h. (203 km.h.).
Cruising speed 110 m.p.h. (176 km.h.).
Stalling speed (engine off, full flap) 29 m.p.h. (46.4 km.h.).
Initial rate of climb 705 ft./min. (215 m. min.).
Take-off run (still air) 172 yds. (157 m.).
Cruising range (one tank) 275 miles (440 km.).
Max. cruising range (two tanks) 545 miles (872 km.).

THE AUSTER AUTOCAR.

The Autocar is a four-seat development of the basic Autocrat, with a re-designed fuselage and more powerful engine. First flight of the prototype was made in August, 1949 and the type is now in production.

There are three versions of the Autocar, the J.5B with the 130 h.p. D.H. Gipsy Major 1 engine; and the J.5G and J.5H with the 155 h.p. Cirrus Major 3 and 150 h.p. Cirrus Major 2 engines respectively.

TYPE.—Four-seat Cabin monoplane.

WINGS.—Similar to the Autocrat, but the inboard end of each wing is constructed with steel ribs to house a fuel tank. Gross wing area 185 sq. ft. (17.14 m.²).

FUSELAGE.—Rectangular section welded steel tube structure with fabric covering.

TAIL UNIT.—Braced monoplane type. Welded steel framework with fabric covering. Fixed tailplane. Rudder has trim-tab, adjustable on the ground and is horn-balanced. Controllable trim-tab in port elevator. External tie-rod bracing. Tailplane span 10 ft. (3.05 m.). Gross tailplane area 24.72 sq. ft. (2.28 m.²). Fin area 5.1 sq. ft. (0.47 m.²). Rudder area 10.1 sq. ft. (0.93 m.²).

LANDING GEAR.—Similar to Autocrat, with steerable tail wheel as an optional fitment.

POWER PLANT.—One 130 h.p. Gipsy Major 1 (J.5B) or 150 h.p. Cirrus Major 2 (J.5H) or 155 h.p. Cirrus Major 3 (J.5G) four-cylinder in-line inverted air-cooled engine. Silencer and metal Fairey-Reed airscrew are standard. Fuel tanks in each wing root, total capacity 32 Imp. gallons (145 litres). Oil tank, capacity 3 gallons (13.6 litres) aft of engine.

ACCOMMODATION.—Enclosed cabin seating two side-by-side, with dual controls if required, and two side-by-side at rear of cabin. Backs of front seats hinge forward for access to rear. Luggage space aft of rear seat. One access door in each side with sliding windows. Passenger's seats can be removed and aircraft employed as a light freighter to carry up to 570 lb. (258 kg.) of freight. A removable freight hatch over rear cabin is available.

DIMENSIONS.—
Span 36 ft. 0 in. (11.0 m.).
Length 23 ft. 2 in. (7.1 m.).
Height 7 ft. 6 in. (2.3 m.).

WEIGHTS AND LOADINGS (J.5B Gipsy-Major 1 engine).—
Weight empty 1,413 lb. (640 kg.).
Weight loaded 2,400 lb. (1,089 kg.).
Wing loading 13 lb./sq. ft. (63 kg./m.²).
Power loading 18.5 lb./h.p. (8.25 kg./h.p.).

WEIGHTS AND LOADINGS (J.5G and J.5H Cirrus Major engine).—
Weight empty 1,367 lb. (621 kg.).
Weight loaded 2,450 lb. (1,112 kg.).
Wing loading 13.3 lb./sq. ft. (64.9 kg./m.²).
Power loading 15.8 lb./h.p. (7.17 kg./h.p.).

PERFORMANCE (J.5B Gipsy-Major 1 engine).—
Max. speed 116 m.p.h. (186 km.h.).
Cruising speed 100 m.p.h. (160 km.h.).
Stalling speed (flaps down) 34 m.p.h. (55 km.h.).
Stalling speed (flaps up) 42 m.p.h. (67.6 km.h.).
Rate of climb 525 ft./min. (2.66 m./sec.).
Service ceiling 11,000 ft. (2,352 m.).
Absolute ceiling 13,000 ft. (3,962 m.).
Still air range 500 miles (805 km.).
Take-off run (5 m.p.h.=8 km.h. wind) 211 yds. (192 m.).
Take-off distance to 50 ft. (15.2 m.) 537 yds. (490 m.).
Landing run (5 m.p.h.=8 km.h. wind) 163 yds. (159 m.).

PERFORMANCE (J.5G and J.5H Cirrus Major engine).—
Max. speed 127 m.p.h. (203 km.h.).
Cruising speed 110 m.p.h. (176 km.h.).
Stalling speed (flaps down) 36 m.p.h. (57.6 km.h.).
Initial rate of climb 710 ft./min. (216.5 m./min.).
Service ceiling 14,000 ft. (4,270 m.).
Absolute ceiling 16,200 ft. (4,940 m.).
Still air range 485 miles (775 km.).
Take-off run (5 m.p.h.=8 km.h. wind) 175 yds. (160 m.).
Take-off distance to 50 ft. (15.2 m.) 320 yds. (293 m.).
Landing run (5 m.p.h.=8 km.h. wind) 130 yds. (120 m.).



An Auster J.5G Autocar (155 h.p. Cirrus Major 3 engine) as supplied to the Royal Australian Navy for liaison duties.

AVRO

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Chief Designer: S. D. Davies, B.Sc., F.R.Ae.S.

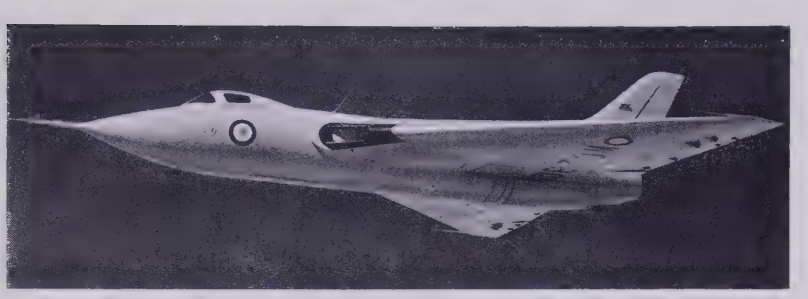
A. V. Roe & Co. was formed in 1910, when the firm advertised itself as constructors of aeroplanes and accessories, and was probably the first firm in Great Britain to do so. The limited company was formed in January, 1913. On the amalgamation of the Hawker and Siddeley interests in 1935, the Avro Company, which formerly was a member of the Siddeley group, became a member of the group of companies controlled by the Hawker Siddeley Group.

In recent years the Avro company has been engaged in an extensive programme of delta-wing research with the 707 Series

of aircraft, culminating in the Avro 698 Vulcan bomber, which is now in super-priority production for the Royal Air Force.

Also in production is the Shackleton four-engined long-range maritime reconnaissance aircraft, which is now in operational service in R.A.F. Coastal Command.

A. V. Roe is also participating in the large-scale production programme of the English Electric Canberra twin-jet bomber under contract with the Ministry of Supply. The first Avro-built Canberra flew on November 25, 1952.



The Avro Type 707A Single-seat delta-wing Research Monoplane.

THE AVRO TYPE 707.

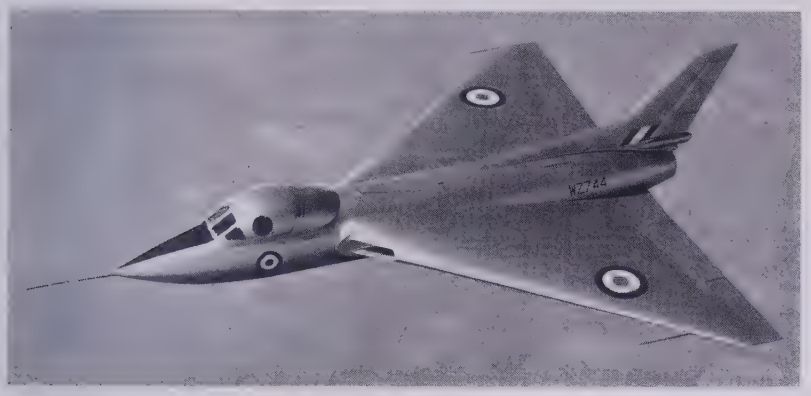
The Avro 707 was the first British aeroplane designed for delta-wing research. Powered by a single Rolls-Royce Derwent gas-turbine, the first 707 made its first flight at Boscombe Down on September 4, 1949. This aircraft was later destroyed in an accident.

A second prototype for low-speed research and known as the Avro 707B, made its first flight on September 6, 1950, at Boscombe Down, and a third high-speed prototype, the 707A, flew for the first time in July, 1951. A second 707A made its maiden flight on February 20, 1953.

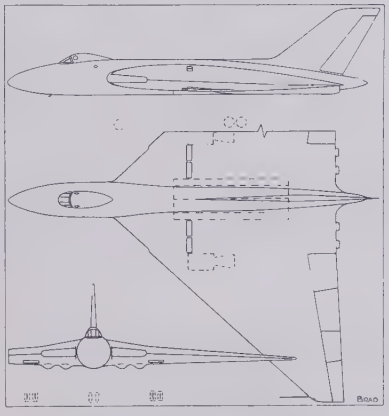
A fourth prototype, the 707C, is a two-seat side-by-side dual control research version of the 707A. It flew for the first time on July 1, 1953.

The 707 is a mid-wing monoplane, with the pilot's cockpit located in the nose forward of the triangular wing. In the 707B the air intakes for the engine are positioned well back along the top surface of the fuselage, whereas in the 707A and 707C the intakes are located in the wing roots.

DIMENSIONS.—
Span (707A and 707C) 34 ft. 2 in. (10.4 m.).
Span (707B) 33 ft. 0 in. (10.1 m.).
Length overall (all models) 42 ft. 4 in. (12.9 m.).
Height (707A) 11 ft. 7 in. (3.53 m.).
Height (707B) 11 ft. 9 in. (3.58 m.).



The Avro Type 707C Two-seat delta-wing Research Monoplane



The Avro Type 698 Vulcan

THE AVRO TYPE 698 VULCAN.

The Vulcan, the first jet bomber to employ the delta wing configuration, is the result of extensive research work with the Avro 707A and 707B.

The prototype Vulcan, powered by four Rolls-Royce Avon turbojet engines, flew for the first time on August 30, 1952, but this aircraft is now fitted with four Armstrong Siddeley Sapphire engines.

The Vulcan has been ordered into super-priority production, the production aircraft to be powered by four Bristol Olympus turbojet engines of the "double-spool" type.

THE AVRO ATLANTIC.

The name Atlantic has been given to a projected design for an inter-continental delta-wing four-jet airliner based on the Vulcan bomber. The Atlantic will have a greatly elongated fuselage which will be able to accommodate from 76 first-class to 131 tourist class passengers in backward-facing seats.

THE AVRO TYPE 696 SHACKLETON.

The Shackleton is now in service in R.A.F. Coastal Command in both the Mk. 1 and Mk. 2 forms. These two versions may be distinguished as follows :

Shackleton M.R. Mk. 1. First production version. General description below refers specifically to this mark. Prototype first flew on March 19, 1949.

Shackleton M.R. Mk. 2. More powerfully armed and cleaner version of Mk. 1. New nose with two additional 20 mm. cannon aimed by gunner who sits above bomb-aimer. Fixed under-nose radome of Mk. 1 deleted and replaced in Mk. 2 by retractable radome located under fuselage aft of bomb-bay. Rear fuselage faired off with transparent terminal cone to provide look-out position. Single-fixed tail-wheel of Mk. 1 replaced by twin retractable wheels. The Mk. 2 prototype flew for the first time on June 17, 1952. Dimensions : Span same as for Mk. 1. Length 87 ft. 4 in. (26.6 m.). Height 16 ft. 9 in. (5.1 m.).



The prototype Avro Vulcan delta-wing Bomber (four Armstrong Siddeley Sapphire turbojet engines).



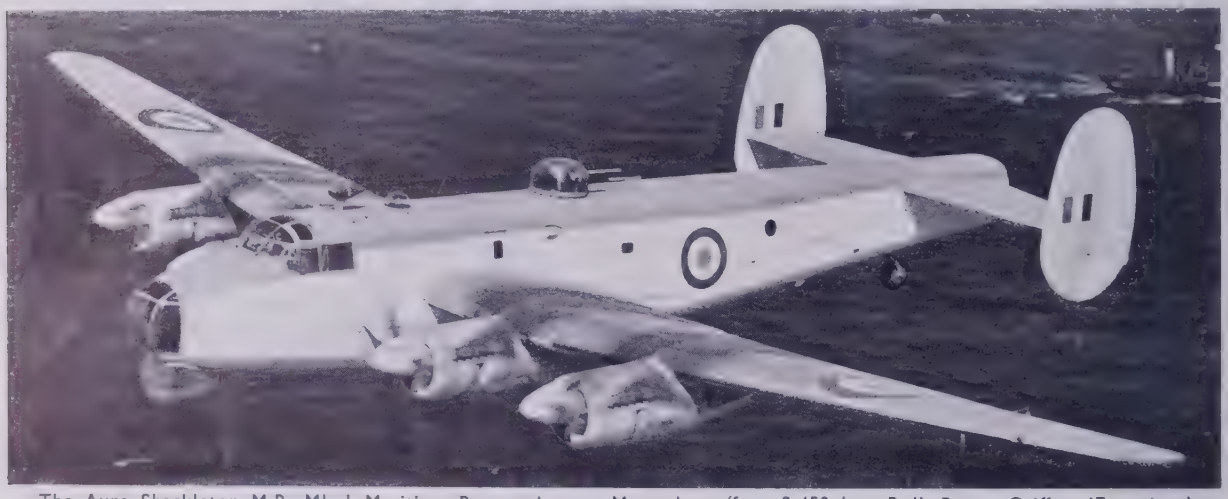
Another view of the prototype Avro Vulcan delta-wing Bomber which is now powered by four Armstrong Siddeley Sapphire turbojet engines.

TYPE.—Four-engined Long-range Maritime Reconnaissance monoplane.

WINGS.—Cantilever mid-wing monoplane. Wing root aerofoil NACA 23018. Incidence 4°. Dihedral on outer planes (true) 4°. Two-spar all-metal structure. Hydraulically-operated split trailing-edge flaps, two between fuselage and inner nacelles, and two outboard of inner nacelles. Total flap area 187.3 sq. ft. (17.40 m.²). Ailerons in outer wing panels, with trim and balance tabs in each. Total aileron area 113.4 sq. ft. (10.55 m.²). Gross wing area 1,421 sq. ft. (132.4 m.²). T.K.S. porous-metal leading-edge de-icing.

FUSELAGE.—Light-alloy stressed skin semi-monocoque structure. Bomb-bay extends along lower half of the three centre fuselage sections, with "clam-shell" bomb-doors.

TAIL UNIT.—Cantilever monoplane tail and end-plate fins and rudders. All-metal structure. Total tailplane area 285.4 sq. ft. (26.6 m.²). Elevator area (including tabs) 87.30 sq. ft. (8.13 m.²). Trim tab area (two) 3.56 sq. ft. (0.331 m.²). Balance tab area (two) 3.54 sq. ft. (0.329 m.²). Total vertical tail area 223 sq. ft. (20.75 m.²). Total rudder area (including combined balance/trim tabs) 100.2 sq. ft. (9.5 m.²). T.K.S. porous-metal leading-edge de-icing on tailplane and fins.



The Avro Shackleton M.R. Mk 1 Maritime Reconnaissance Monoplane (four 2,450 h.p. Rolls-Royce Griffon 67 engines).

LANDING GEAR.—Retractable tail-wheel type. Main wheels each carried between two oleo-pneumatic shock-absorbing legs, retract backward hydraulically into inner engine nacelles. Single fixed (Mk1) or dual retractable (Mk 2) tail-wheel unit.

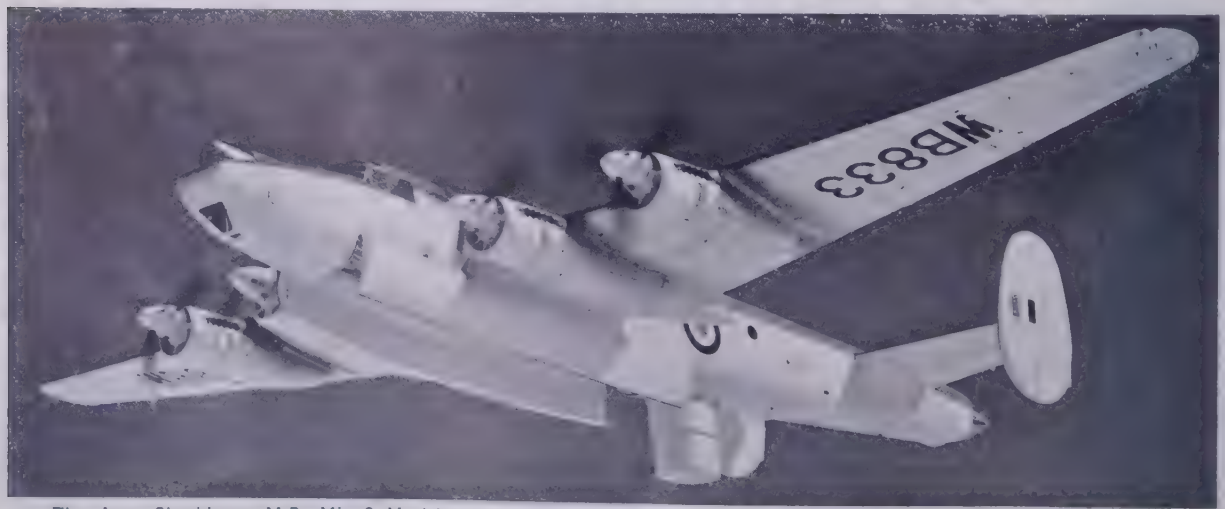
POWER PLANT.—Four 2,450 h.p. Rolls Royce Griffon 67 twelve-cylinder Vee liquid-cooled engines, each driving a de Havilland six-blade co-axial counter-rotating constant-speed fully-feathering airscrew, diameter 13 ft. (3.96 m.).

ACCOMMODATION.—Crew of ten. Pilot's compartment in forward fuselage section, seating two side-by-side. Other crew positions in nose and fuselage.

ARMAMENT.—Two 20 mm. cannon in Bristol B.17 dorsal turret. Large single bomb compartment can accommodate variety of anti-shipping weapons in many combinations. Equipment includes extensive radio and radar, provision for carrying A/S.R. lifeboat, etc.

DIMENSIONS.—
Span 120 ft. 0 in. (36.6 m.).
Length 77 ft. 6 in. (23.6 m.).
Height 17 ft. 6 in. (5.3 m.).

WEIGHTS AND PERFORMANCE.—
No data available.



The Avro Shackleton M.R. Mk. 2 Maritime Reconnaissance Monoplane (four 2,450 Rolls-Royce Griffon 67 engines).



The Blackburn and General Type 60 Universal Mk. 1 (four 2,020 h.p. Bristol Hercules 730 engines).

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SCOTTISH WORKS: CASTLE ROAD, DUMBARTON.

LONDON OFFICE: 43, BERKELEY SQUARE, LONDON, W.1.

Directors: R. Blackburn, O.B.E., A.M.I.C.E., M.I.Mech.E., F.R.Ae.S. (Chairman), E. Turner, A.C.A. (Managing Director), Major F. A. Bumpus, B.Sc., A.R.C.S., Wh.Sc., F.R.Ae.S., N. E. Rowe, C.B.E., B.Sc., M.I.Mech.E., F.R.Ae.S., Whit.Ex., Sir Maurice Bonham Carter, K.C.B., K.C.V.O., W. A. Hargreaves, M.B.E., A.M.I.C.E., F.R.Ae.S. and Air Vice-Marshal H. N. Thornton, C.B.E.

Secretary: R. H. Stone, A.C.A.

Technical Advisor: G. E. Petty, F.R.Ae.S., M.I.Mech.E.

Chief Designer: B. P. Laight, A.F.R.Ae.S.

The Blackburn Aeroplane Company was founded by Mr. Robert Blackburn, who designed, built and flew his first aeroplane in 1909 and has continued to manufacture aircraft ever since.

In 1930 the Cirrus Hermes Engineering concern was taken over and Blackburns thus added Cirrus aero-engines to their range of products. In 1936 the public company of Blackburn Aircraft Ltd. was formed.

In the same year, the Blackburn Company came to an arrangement with the famous Scottish shipbuilding company of William Denny & Bros. Ltd., of Dumbarton, to organize and operate jointly a factory on the Clyde. In 1947 this company became a separate subsidiary under the title of Blackburn (Dumbarton) Ltd.

In January, 1949, Blackburn Aircraft, Ltd. merged with General Aircraft, Ltd. of Feltham, Middlesex.

Blackburn and General Aircraft has concentrated on the development of the Universal four-engined freighter, the design of which was inherited from General Aircraft. The Universal Mk. 1 was completed at Brough and has been engaged in development flying since June, 1950. A higher-powered Mk. 2 has been built and a military version of this heavy transport has been ordered for the R.A.F. as the Beverley C. Mk. 1. Its development as a civil aircraft continues.

Details of the Cirrus Engine Division of Blackburn and General Aircraft, Ltd. will be found elsewhere. The British manufacturing rights for Turboméca gas-turbines was acquired by Blackburn and General in October, 1952.

THE BLACKBURN AND GENERAL TYPE 60 UNIVERSAL Mk. 1.

The Universal Mk. 1 is basically a General Aircraft design (G.A.L.60), work on which started in 1946 before the two companies merged.

The prototype Mk. 1, which was built to the order of the Ministry of Supply, was completed by Blackburn and General at Brough and flew for the first time on June 20, 1950. The Mk. 1, powered by four 2,020 h.p. Bristol Hercules 730 engines, has been fully described in the last two editons of this Annual.

THE BLACKBURN AND GENERAL TYPE 65 UNIVERSAL Mk. 2.

R.A.F. name: Beverley.

The second prototype Universal, the Mk. 2, which flew for the first time in June, 1953, is powered by four Bristol Centaurus engines and other modifications include revised tail-boom and dihedral on the outer wings. The Mk. 2 is the forerunner of the Beverley C. Mk. 1 transport which has been ordered for the Royal Air Force.

The civil version of the Beverley, which is described below, will continue to be known as the Universal. Although the outward configuration will be similar, there are considerable differences in equipment, etc. between the two versions.

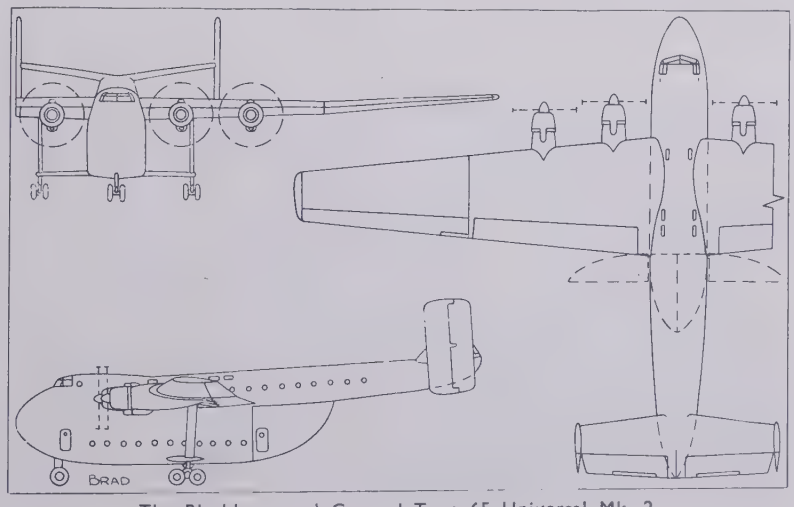
TYPE.—Heavy Freight and/or Passenger Transport.

WINGS.—High-wing cantilever monoplane. Modified R.A.F. 34 wing section. Aspect ratio 9. Dihedral 0°54′31″ inner wings, 3°54′31″ outer wings. Chord 25 ft. 8 in. (7.84 m.) at root (on centre-line), 10 ft. 6 in. (3.2 m.) at tip. All-metal light alloy structure. Wing in four main sections, two inner and two outer, plus detachable tips, with no centre section. Main spar at 25% chord and rear spar at 55% chord. Warren-girder type ribs, widely spaced. Longitudinal stringers reinforce skin except over two outer fuel cells, where chord-wise beams are used. Thermal leading-edge de-icing. NACA slotted trailing-edge flaps over inner wing sections. Electric infinitely-variable flap operation. Modified Frise type ailerons, with trim and balance tabs on both sides. Saunders push-pull torque control system, combining aileron and trim controls in single run. Fairey hydraulic power-control units. Flap area (each) 189 sq. ft. (17.5 m.²). Aileron area (aft of hinge) (each) 84 sq. ft. (7.8 m.²). Tab area (aft of hinge) (each) 5.5 sq. ft. (0.51 m.²). Gross wing area 2,916 sq. ft. (270 m.²).

FUSELAGE.—All-metal light-alloy structure in four sections; nose compartment, main freight compartment, crew compartment, and tail boom compartment. Main freight and nose compartments have built-up frames, heavily re-inforced floor and closely-spaced lengthwise stringers to stiffen the skin. Skin and stringer construction of crew compartment with light channel-section frames, and tail boom roof and rear fuselage similar with addition of extruded section stringers. Rear end of main freight compartment closed by pair of clamshell doors.

TAIL UNIT.—Cantilever monoplane tailplane with outrigged fins and rudders. Dihedral on tailplane 7° 34′. Two-spar tailplane with pressed sheet ribs. Fin construction similar. Elevators and rudders are single-spar structures with pressed sheet ribs, all metal-covered. Trim-tabs in all surfaces. Control system as for ailerons. Gross tailplane and elevator area 526 sq. ft. (48.9 m.²). Total elevator area (aft of hinge) 145 sq. ft. (13.45 m.²). Trim tab area each 7.4 sq. ft. (0.687 m.²). Gross fin and rudder area 391 sq. ft. (36.3 m.²). Total rudder area (aft of hinge) 62.4 sq. ft. (5.79 m.²). Trim tab area each 6.3 sq. ft. (0.585 m.²). Tailplane span 42 ft. 2 in. (12.85 m.

LANDING GEAR.—Fixed nose-wheel type with four-wheel bogie main units. Main Lockheed shock-absorber units attached to wings at upper ends and supported by horizontal sponsons from bottom corners



The Blackburn and General Type 65 Universal Mk. 2.



The Blackburn and General Type 65 Universal Mk. 2 (four 2,850 h.p. Bristol Centaurus 173 engine).

of fuselage frames. Two built-up spars converging at shock-absorber leg in each light-alloy covered sponson. Twin Dunlop nose wheels sprung by Lockheed shock-absorber leg. Nose-wheel unit can be power-steered through an angular movement of ± 45°. Main wheels mounted on beam which is pivoted on main shock-absorber and sprung by Lockheed damper strut. Hydraulic differential braking on main wheels, which incorporate the Maxaret non-skid system.

Power Plant. Four Bristol Centaurus 173 eighteen-cylinder radial air-cooled engines with single-speed superchargers, each developing 2,850 h.p. for take-off at 2,800 r.p.m. with water/methanol injection. Rated powers; normal climb and continuous rich mixture cruising, 2,390 h.p. at 4,500 ft. (1,370 m.); lean mixture continuous cruising 1,720 h.p. at 11,500 ft. (3,500 m.). Access to power plants in flight or for ground maintenance through rear auxiliary bulkhead from internal wing crawlway. D.H. four-blade hollow steel reversible-pitch braking airscrews 16 ft. 6 in. (5.03m.) diameter, with electric de-icing. Normal fuel carried in four flexible tanks, two in each inner wing. Capacity of each inner tank 1,140 Imp. gallons (5,180 litres), of each outer tank 656 Imp. gallons (2,980 litres). Total permanent tankage 3,590 Imp. gallons (16,300 litres). Provision for an additional tank in each outer wing of 609 Imp. gallons (2,760 litres) capacity. Pressure fueling and de-fueling of all tanks.

Accommodation.—Crew of three or four, two pilots, navigator and/or radio-operator, on separate flight deck above main freight compartment. Supply-dropping sighting position in extreme nose in military version. Forward freight hold in extreme nose 11 ft. 5 in. (3.48 m.) long; main freight compartment 44 ft. 7 in. (13.6 m.) long; tail boom compartment 43 ft. 11 in. (13.4 m.) long. Re-inforced freight floor with 164 lashing points, and lashing rings and rails along fuselage walls. Provision in tail boom for 42 passenger seats when aircraft is used as freighter. As a high-density commercial passenger transport accommodation is for 73 passengers on lower deck and 49 in tail boom, or, with an additional deck in main freight compartment, 43 passengers on lower deck, 47 on middle deck and 42 in tail boom.

Equipment.—Full radio and radar. Hinged loading ramps at rear of freight floor may be removed when not required.

Dimensions.—
Span 162 ft. (49.5 m.).
Length 99 ft. 2 in. (30.2 m.).
Height overall 38 ft. 5 in. (11.7 m.).

Weights.—
Basic weight (normal equipment) 77,200 lb. (35,000 kg.).
Payload, fuel and oil 57,800 lb. (26,200 kg.).
Gross weight 135,000 lb. (61,200 kg.).

Performance (Estimated at 135,000 lb.—61,200 kg.).
Max. speed 238 m.p.h. (384 km.h.) at 5,700 ft. (1,740 m.).
Max. continuous cruising speed 223 m.p.h. (359 km.h.) at 5,000 ft. (1,525 m.).
Max. lean mixture cruising speed 194 m.p.h. (312 km.h.) at 12,500 ft. (3,800 m.).
Recommended cruising speed 175 m.p.h. (282 km.h.) at 8,000 ft. (2,440 m.).

Payloads (with fuel reserves for 230 miles=370 km. plus ¼ hr. stand off and 5% contingencies).
46,800 lb. (21,200 kg.) over 250 miles (402 km.) stage length.
42,800 lb. (19,400 kg.) over 500 miles (804 km.) stage length.
35,000 lb. (15,900 kg.) over 1,000 miles (1,610 km.) stage length.

BOULTON PAUL

BOULTON PAUL AIRCRAFT, LTD.

Head Office, Works and Aerodrome: Wolverhampton.

Incorporated: June, 1934.

Chairman and Managing Director: J. D. North, F.R.Ae.S., M.I.Mech.E., F.S.S.

Directors: J. Kissane, C.A., R. Beasley (General Manager), G. C. Haynes, A.C.A. (Secretary) and F. F. Crocombe, B.Sc., A.C.G.I., D.I.C., F.R.Ae.S. (Chief Engineer).

Boulton Paul Aircraft Ltd. was formed in 1934 to take over the old-established Aircraft Department of Boulton & Paul Ltd. of Norwich which began the manufacture of aircraft in 1915.

In addition to the design and construction of aircraft, Boulton Paul has also designed and produced an extensive range of electro-hydraulically operated gun-turrets. More recently, the company has specialised in the development of electronic aids to research, testing and design. It has also developed high-fidelity-power control systems for aircraft and its power units are incorporated in the Saunders-Roe Princess flying-boats and other types.

The first aircraft produced by the company after the War was the Balliol, and this type is now in production for the R.A.F. and the Royal Navy.

THE BOULTON PAUL P.108 BALLIOL.

The P.108 was originally designed as an all-purpose advanced trainer to be fitted with an Armstrong Siddeley Mamba or Rolls-Royce Dart airscrew turbine engine.

The type was subsequently named Balliol, and the following three major versions have since appeared.

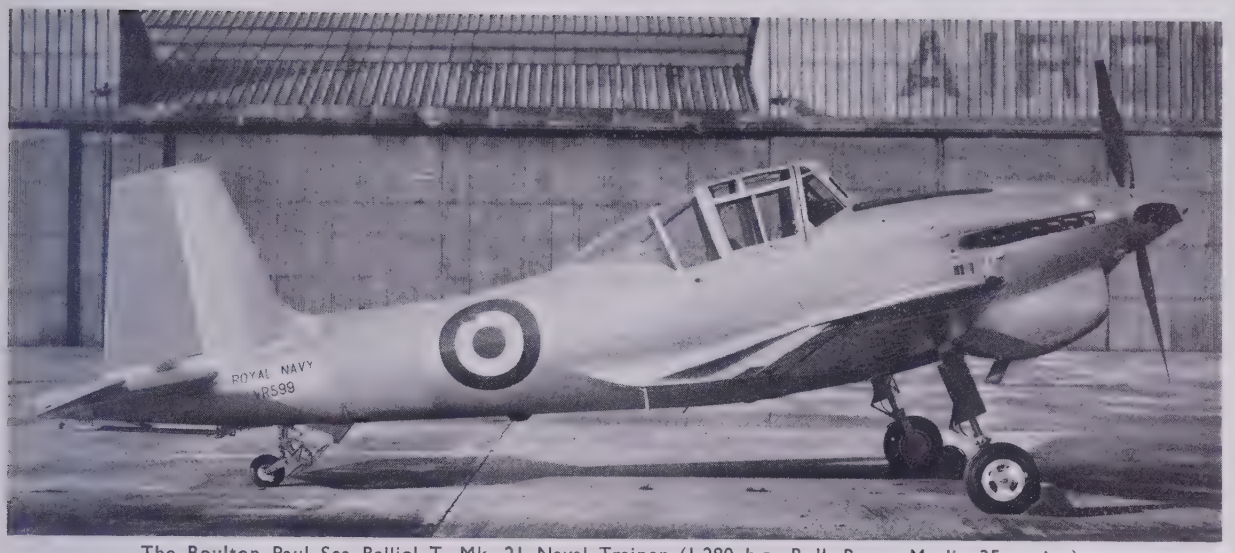
Balliol T. Mk. 1. This designation applies to the original three-seat training version with an Armstrong-Siddeley Mamba turboprop engine. The first of two prototypes made its first flight on March 24, 1948, and was the first aeroplane in the World to fly solely with a turboprop for power.

Balliol T. Mk. 2. This mark was developed when the R.A.F. requirements for training aeroplanes were modified. It is powered by a Rolls-Royce Merlin 35 engine, and the third seat of the Mk.1 is deleted. Otherwise, the two versions are the same in all essentials. The first Balliol T.Mk.2 made its first flight on July 10, 1948. In service with the Royal Air Force.

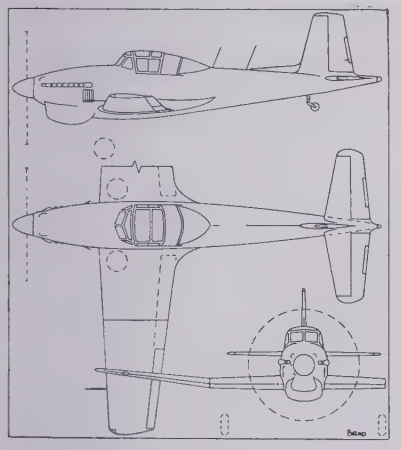
Sea Balliol T. Mk. 21. One Rolls-Royce Merlin 35 engine. A naval version of the Balliol T. Mk. 2 ordered in quantity by the Royal Navy. Special features of



The Boulton Paul Balliol T. Mk. 2 Trainer (1,280 h.p. Rolls-Royce Merlin 35 engine).



The Boulton Paul Sea Balliol T. Mk. 21 Naval Trainer (1,280 h.p. Rolls-Royce Merlin 35 engine).



The Boulton Paul Balliol T. Mk. 2.

the Sea Balliol include an arrester hook, smaller diameter airscrew, strengthened landing-gear and changed instruments and equipment.

The following description refers primarily to the Balliol T. Mk. 2.

TYPE.—Two-seat Advanced Trainer.

WINGS.—Cantilever low-wing monoplane. Wing section NACA 65. Mean thickness/chord ratio 18.5. All-metal stressed skin two-spar structure. Outer wing sections fold upwards. Split flaps and dive brakes are operated pneumatically. Ailerons are interchangeable from port to starboard. Wing tips quickly detachable. Access panels at all servicing points. Gross wing area 250 sq. ft. (23.2 m.²).

FUSELAGE.—Circular section structure; nose portion built up of light alloy and steel tubes with quickly detachable fairing panels; remainder light alloy stressed skin monocoque. The fuselage breaks down into four unit sections for transport and quickly removable access panels are provided at all servicing points.

TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering of movable surfaces. The two halves of the tailplane and the fin are identical and interchangeable, as are the port and starboard elevators. Horizontal tail area 51.4 sq. ft. (4.78 m.²). Vertical tail area 25.3 sq. ft. (2.35 m.²).

LANDING GEAR.—Main wheels retractable. Pneumatic retraction. Cantilever oleo-pneumatic legs are interchangeable from port to starboard. Shock absorbing and damping characteristics are suitable for deck landings. Non-retractable tail-wheel is steerable, but steering connection can be disengaged at will from the cockpit, when the tail-wheel becomes fully castoring and self-centering. It can also be locked in the fore-and-aft position for the take-off. Track 15 ft. (4.57 m.).

POWER PLANT.—One Rolls-Royce Merlin 35 twelve-cylinder Vee liquid-cooled engine rated at 1,245 h.p. at 11,500 ft. (3,510 m.) combat rating, 1,060 h.p. at 9,250 ft. (2,280 m.) for continuous cruising, and with 1,280 h.p. available for take-off. de Havilland four-blade constant-speed airscrew, 11 ft. 3 in. (3.43 m.) diameter. One fuel tank in fuselage and one in each wing, total capacity 125 Imp. gallons (570 litres). One drop tank may be attached beneath each wing.

ACCOMMODATION.—Side-by-side seating for instructor and pupil with full dual control. Electically-operated sliding hood. Cockpit heating and ventilation. Alternative equipment covers the full range of requirements for advanced training in flying, navigation, gunnery, bombing, photography and glider towing.

DIMENSIONS.—
- Span 39 ft. 4 in. (12 m.).
- Width (wings folded) 21 ft. 8 in. (6.6 m.).
- Length 35 ft. 1½ in. (10.7 m.).
- Height (over airscrew, tail down) 12 ft. 6 in. (3.8 m.).

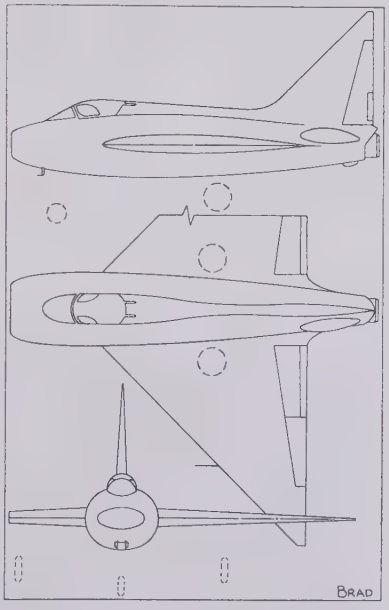
WEIGHTS AND LOADINGS.—
- Weight empty (with 884 lb.=402 kg. fixed equipment) 6,730 lb. (3,053 kg.).
- Removable equipment 263 lb. (120 kg.).
- Fuel and oil 968 lb. (439 kg.).
- Crew (2) including parachutes, cushions and dinghies 448 lb. (204 kg.).
- Weight loaded 8,410 lb. (3,817 kg.).
- Wing loading 33.64 lb./sq. ft. (164.5 kg./m.²).
- Power loading 6.57 lb./h.p. (2.95 kg./h.p.).

PERFORMANCE.—
- Max. speed at 9,000 ft. (2,740 m.) 288 m.p.h. (465 km.h.).
- Max. continuous cruising speed (rich mixture) at 8,000 ft. (2,440 m.) 266 m.p.h. (430 km.h.).
- Max. continuous cruising speed (weak mixture) at 5,500 ft. (1,675 m.) 231 m.p.h. (372 km.h.).
- Stalling speed 83 m.p.h. (134 km.h.).
- Time to 15,000 ft. (4,575 m.) 10 mins.
- Service ceiling 32,500 ft. (9,910 m.).
- Take-off distance to 50 ft. (15.25 m.) 450 yds. (412 m.).
- Landing distance from 50 ft. (15.25 m.) 650 yds. (595 m.).
- Endurance at 222 m.p.h. (357 km.h.) at 10,000 ft. (3,050 m.) 3 hours.

THE BOULTON PAUL P.111.

The P.111 is a single-seat high-speed research aeroplane with the delta wing plan-form. The wing is mounted in the mid position, and houses the inwards retracting main landing-gear units and the fuel tanks. Control is effected through elevons in the wing and a rudder.

Power is provided by a single Rolls-Royce Nene turbojet engine in the fuselage. A parachute is carried in a fairing on the port side of the rear fuselage and can be



The Boulton Paul P.111.



The Boulton Paul P.111A Delta-wing Research Monoplane.

used to reduce landing speed and landing run.

First flight of the P.111 was made at Boscombe Down on October 10, 1950.

A second aircraft, the P.111A, with fuselage air brakes and other slight modifications, was flown for the first time on July 2, 1953.

DIMENSIONS.
Span 33 ft. 5½ in. (10.21 m.).
Length 26 ft. 1 in. (7.95 m.).
Height over fin 12 ft. 6½ in. (3.82 m.).
Wheel track 14 ft. 5 in. (4.4 m.).

WEIGHTS AND PERFORMANCE.
No data available.

THE BOULTON PAUL P.120.

The P.120 delta-wing research monoplane was similar to the P.111 but was fitted with an all-moving tailplane, with fin and rudder of modified shape to accommodate the new tail. It also had new dive brakes. The power-plant was a Rolls-Royce Nene.

This aircraft made its first flight on August 6, 1952, but was destroyed in an accident caused by flutter during a test flight on August 29, 1952.



The Boulton Paul P.120 Delta-wing Research Monoplane.

DIMENSIONS.—
Length 29 ft. 7½ in. (9.03 m.).
Span 33 ft. 5½ in. (10.21 m.).

BRISTOL

THE BRISTOL AEROPLANE CO., LTD.

HEAD OFFICE, WORKS AND AERODROME: FILTON, BRISTOL.

LONDON OFFICE: 6, ARLINGTON STREET, ST. JAMES'S, S.W.1.

Established: 1910.

Directors: Sir William G. Verdon Smith, C.B.E., J.P. (Chairman), Sir G. Stanley White, Bt. (Deputy Chairman), G. S. M. White and Sir Reginald Verdon Smith, M.A., B.C.L., J.P. (Joint Managing Directors), Sir Alec Coryton, K.C.B., K.B.E., M.V.O., D.F.C. (Divisional Managing Director, Engine Division), Capt. K. J. G. Bartlett, C.B.E., A.F.R.Ae.S., M.Inst.T., M.S.A.E. (Sales Director), C. F. Uwins, O.B.E., A.F.C., F.R.Ae.S. (Divisional Managing Director, Aircraft Division), Brian Davidson, M.A. (Commercial Director), Dr. A. E. Russell, D.Sc., F.R.Ae.S., F.I.Ae.S. (Chief Designer, Aircraft Division), Dr. S. G. Hooker, O.B.E., D.Phil., D.I.C., F.R.Ae.S. (Chief Engineer, Engine Division), and W. Masterton, C.A. (Financial Director).

Secretary: J. F. Harper.

General Manager (Aircraft Division): R. S. Brown, M.I.P.E.

Chief Development Engineer (Aircraft Division); H. J. Pollard, F.R.Ae.S.

Chief Test Pilot: A. J. Pegg, M.B.E.

Divisional Secretary (Aircraft Division): M. W. Wright.

Service Manager (Aircraft Division): T. W. Campbell.

Founded in 1910 by the late Sir George White, Bt., this company was originally known as The British and Colonial Aeroplane Company Ltd.

Now in production are the Bristol Type 175 Britannia medium/long-range airliner, on order for B.O.A.C. and other operators, the Type 170 Freighter civil transport, in service throughout the World, the Type 171 helicopter, and the twin-engined/twin-rotored Type 173 helicopter, the prototype of which, the Type 173 Mk. 1, first flew on January 3, 1952.

The company is also engaged on development of guided weapons and their power units.

Details of the activities of the Aero-Engine Division of the Bristol Aeroplane Co., Ltd. will be found in the Aero-Engine Section.

THE BRISTOL TYPE 175 BRITANNIA.

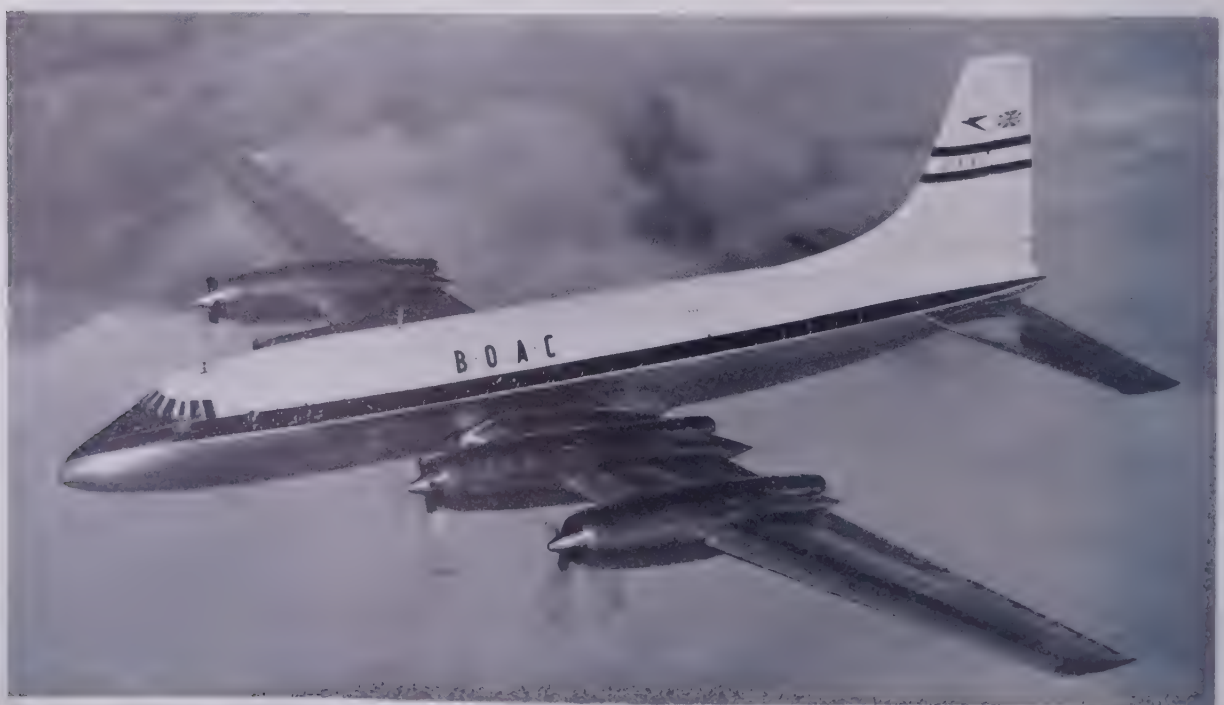
Two prototypes and a fleet of 25 production aircraft of this type are being built for B.O.A.C. and are due to enter service in 1955. The Britannia is a considerable advance on the initial Medium-Range Empire transport proposed by B.O.A.C. in 1947. All the aircraft at present under construction will have four Bristol Proteus turboprop engines.

The first production version of the Britannia, the Mk. 100, will have a basic interior layout permitting ready conversion from first class accommodation for some 60 passengers to a "tourist" version carrying 93 passengers, or *vice versa*. In either version the passenger accommodation can be reduced to permit the carriage of extra freight on route sectors where mixed traffic is offered.

Three further versions, the Mk. 200 (freighter), Mk. 250 (mixed freight and passenger version) and Mk. 300 (passenger airliner), have been announced. All these marks are larger and more powerful developments of the Mk. 100. Each will have a fuselage 10 ft. 3 in. (3.12 m.) longer than that of the Mk. 100, and the gross weight will be increased from 140,000 lb. (63,600 kg.) to 155,000 lb. (70,370 kg.). They will all be powered by four Proteus 750 engines. These versions will be available for delivery in 1956-57.

TYPE.—Four-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 25017 at root, tapering



The Bristol Type 175 Britannia Airliner (four 3,780 h.p. Bristol Proteus 705 turboprop engines).

to NACA 4413 modified at tip. Aspect ratio 9.53. Dihedral constant from roots. 3°. Incidence 3°. Root chord 22 ft. 7¼ in. (6.88 m.). All-metal two-spar structure. Ailerons in outer wings and double-slotted trailing-edge flaps each side on inner wing. Thermal anti-icing. Aileron area each 70 sq. ft. (6.52 m.²). Gross wing area 2,055 sq. ft. (195.0 m.²).

FUSELAGE.—All-metal monocoque structure pressurised to 8.25 lb./sq. in. Maximum diameter 12 ft. (3.66 m.).

TAIL UNIT.—Cantilever metal tailplane and single fin and rudder. All-metal structure. Servo tabs in all control surfaces. Tailplane span 55 ft. (16.7 m.). Gross tailplane area 588 sq. ft. (54.75 m.²). Elevator area (aft of hinge) 85 sq. ft. (7.92 m.²).

LANDING GEAR.—Retractable nose-wheel type. Main units beneath inner nacelles each have a four-wheel bogie. Nose unit has twin wheels. Wheel track (bogie centres) 31 ft. 0 in. (9.45 m.). Wheelbase 35 ft. 3.4 in. (10.80 m.).

POWER PLANT.—Four 3,780 e.p.h. Bristol Proteus 705 (Mark 100) or 4,150 e.h.p. Proteus 750 (Marks 200, 250 and 300) turboprop engines driving four-blade airscrews. Main fuel tankage in wing-spar box.

ACCOMMODATION (Mk. 100).—Crew of 3-5 and up to 92 passengers in pressurized cabin. Main passenger accommodation in two cabins, in centre fuselage and rear fuselage, with main entrance (port side) between. Additional entrance and pantry forward. Baggage compartment immediately aft of flight deck. Freight holds below cabin floor.

ACCOMMODATION (Mk. 250).—For 87 passengers. Also 10,000 lb. (4,540 kg.) of freight on main deck, in addition to main freight holds.

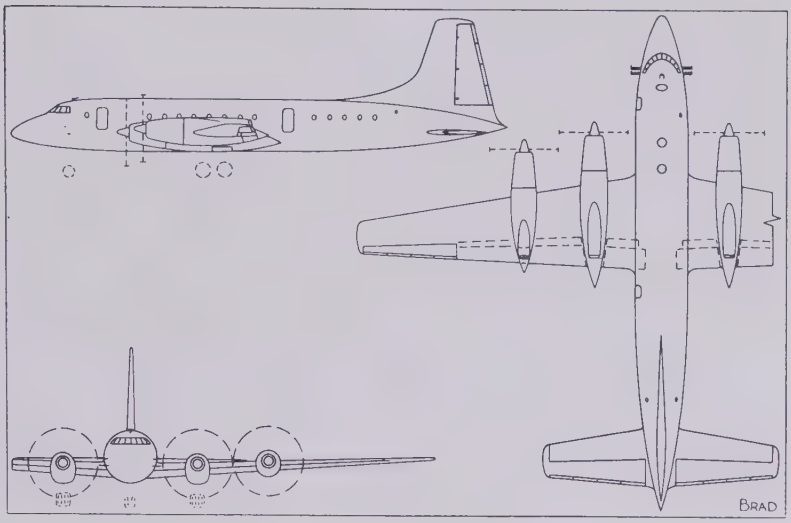
ACCOMMODATION (Mk. 300).—For 104 passengers.

DIMENSIONS (Nominal).—
Span (all marks) 140 ft. (42.65 m.).
Length (Mk. 100) 114 ft. (34.7 m.).
Length (Mks. 200, 250 and 300) 124 ft. 3 in. (37.8 m.).
Height (all marks) 36 ft. 8 in. (11.2 m.).

WEIGHTS (designed).—
Payload (Mk. 100) 25,000 lb. (11,340 kg.).
Payload (Mk. 200) 43,000 lb. (19,520 kg.).
Payload (Mk. 250) 36,000 lb. (16,345 kg.).
Payload (Mk. 300) 30,000 lb. (13,620 kg.).
Weight loaded (Mk. 100) 140,000 lb. (63,600 kg.).
Weight loaded (Mks. 200, 250 and 300) 155,000 lb. (70,370 kg.).

PERFORMANCE (Mk. 100—estimated).—
Max. speed 384 m.p.h. (614 km.h.) at 25,000 ft. (7,265 m.).
Still air range with max. payload 3,750 miles (6,000 km.) at 340 m.p.h. (544 km.h.) at 30,000 ft. (9,150 m.).
T.O. distance to 50 ft. (15.25 m.) at S/L. no wind 4,780 ft. (1,458 m.).
Landing distance from 50 ft. (15.25 m.) at S/L. no wind 3,265 ft. (996 m.).

PERFORMANCE (other marks—estimated).—
Max. speed 350 m.p.h. (560 km.h.) at 25,000 ft. (7,265 m.) (Mks. 200 and 250), or 400 m.p.h. (640 km.h.) at 22,000 ft. (6,710 m.) (Mk. 300).



The Bristol 175 Britannia Mk. 100 Airliner.

Still air range with max. payload 3,250 miles (5,200 km.) (Mk. 200), or 3,310 miles (5,296 km.) (Mk. 250), or 3,930 miles (6,288 km.) (Mk. 300), all at 350 m.p.h. (560 km.h.) at 30,000 ft. (9,150 m.).
T.O. distance to 50 ft. (15.25 m.) at S/L. no wind (all marks) 5,130 ft. (1,565 m.).
Landing distance from 50 ft. (15.25 m.) at S/L. no wind (all marks) 3,500 ft. (1,068 m.).

THE BRISTOL TYPE 170.

Originally designed as a freight or passenger aircraft capable of transporting a large payload over comparatively short distances, the Type 170 has been developed to give extended range and to carry a greater payload. The latest version, known as the Mk. 31, has a British C. of A. in Category A for a maximum take-off weight of 44,000 lb. (19,958 kg.).

The current versions of the Type 170 are :—

Mark 31. Freighter version. Nose opening doors as on earlier marks and 2,300 cub. ft. (65.2 m.³) of hold and lobby space available for cargo. Normally the Freighter version is provided with soundproofing in pilot's compartment only. Ventilation and heating can be supplied for the hold as well as the cockpit.

Mark 31E. Passenger or mixed traffic version. Differs from Freighter by the normal installation of full sound-proofing, heating and ventilation and provision of seat attachments in floor of hold. Maximum number of seats which can be fitted is 56, with fuel for a still air stage length of 540 miles (870 km.). Normally, seating for 44 is supplied, which permits fuel to be carried for 1,030 miles (1,658 km.). A movable bulkhead enables the hold to be adapted for mixed passenger and freight use or, by complete removal of bulkhead and all seats, for freight only.

Mark 32. Version with lengthened fuselage forward of wings, six of which have been supplied to Silver City Airways. Fuselage length increased to 73 ft. 6 in. (22.42 m.), the additional 5 ft. (1.52 m.) being added forward of the wings. Car hold increased in length from 31 ft. 8 in. (9.65 m.) to 37 ft. 6 in. (11.43 m.) and capable of extension to 42 ft. 3 in. (12.88 m.) by movable partition to enable aircraft to carry three cars of 14 ft. (4.27 m.) length or two of the largest American automobiles. Accommodation for passengers behind car hold increased from 12 to 20. Additional windows fore and aft, sound-proofing, luggage racks, etc. Fin area increased by 10 sq. ft. (0.93 m.²) by extension to top of main fin and larger dorsal fin. Performance same as for standard Mk. 31.

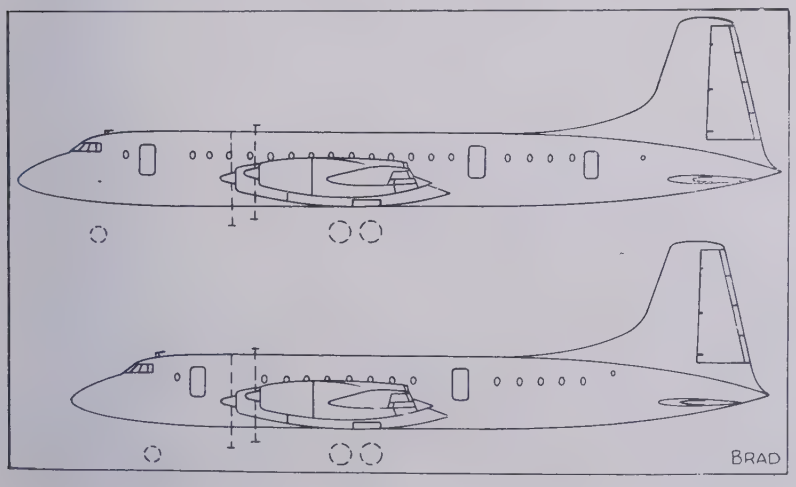
Apart from the large number of civil versions which have been supplied for use in all parts of the World for a wide variety of duties, the Type 170 has also been produced as a military aircraft and is in service in the Royal Australian Air Force, Royal Canadian Air Force, Royal New Zealand Air Force and Royal Pakistan Air Force.

TYPE.—Twin-engined Passenger or Freight Transport.

WINGS.—Cantilever high-wing monoplane. Aerofoil section R.A.F. 28 (modified) with thickness/chord ratio of 17.5% at root, decreasing to 15% at tip. All-metal two-spar structure. All-metal constant-chord Frise ailerons with fabric covering and controllable trim-tab in each. Aileron area (each) 39.2 sq. ft. (3.64 m.²). Pneumatically-operated all-metal split trailing-edge flaps in two sections each side between ailerons and fuselage. Total flap area 82.7 sq. ft. (7.68 m.²). Gross wing area 1,487 sq. ft. (138 m.²).

FUSELAGE.—All-metal structure in two main sections. Nose-section is split on vertical centre-line and hinged to open for loading.

TAIL UNIT.—All-metal cantilever monoplane type. Rudder and elevators have metal frames and fabric covering. Rudder fitted with controllable spring and trim-tabs, and elevators with spring-tab in port and trim-tab in starboard. Tailplane area 307 sq. ft. (28.5 m.²). Elevator area (each) 34.2 sq. ft. (3.17 m.²). Fin (including dorsal fin) area 164.6 sq. ft. (15.29 m.²). Rudder area aft of hinge line 36.3 sq. ft. (3.37 m.²). Tailplane span 40 ft. (12.192 m.).



Side view outlines of the Bristol Britannia Mk. 100 (below) and Mk. 300 (above).



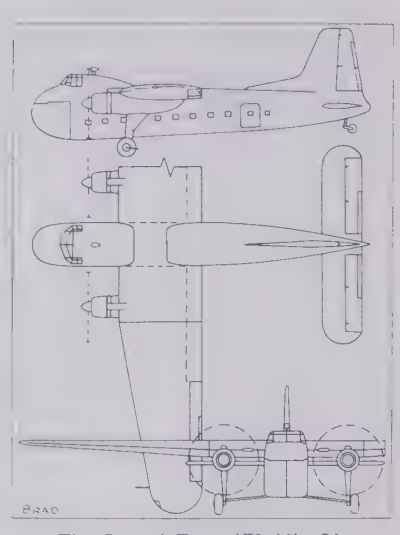
The Bristol Type 170 Mk. 31 Freighter (two 2,000 h.p. Bristol Hercules 734 engines).

LANDING GEAR.—Fixed tail-wheel type. Dowty liquid-spring shock-absorbers. Dunlop pneumatic brakes. Castoring tail-wheel on Dowty liquid-spring shock-absorber unit. Track 27 ft. 4 in. (8.54 m.). Wheel base (tail down) 46 ft. 5⅝ in. (14.17 m.).

POWER PLANT.—Two 2,000 h.p. Bristol Hercules 734 fourteen-cylinder two-row radial sleeve-valve air-cooled engines. de Havilland four-blade constant-speed full-feathering metal airscrews, 14 ft. (4.27 m.) diameter. Two 350 Imp. gallon (1,592 litre) alloy fuel tanks in centre-section, one on each side of fuselage. Two tanks in each outer wing 135 Imp. gallons (616 litres) and 100 Imp. gallons (455 litres). Oil capacity 44 Imp. gallons (200 litres).

ACCOMMODATION (Mk. 31).—Crew of three in flight compartment, reached via hatch in floor and ladder on starboard wall of main freight hold. Pilot (on port) and co-pilot seated side-by-side with dual controls and radar operator aft of the co-pilot. Main cargo hold is 31 ft. 8 in. long × 6 ft. 8 in. high (9.65 m. × 2.03 m.) with volume of 2,300 cub. ft. (57.2 m.³). Tying-down points in floor. Mechanically-operated twin nose doors permit direct loading of freight and allow vehicles to be driven in via a ramp. At rear of main hold is smaller freight compartment 8 ft. 4 in. long 8 ft. wide × 6 ft. 8 in. high (2.54 m. × 2.44 m. × 2.03 m.) with volume of 240 cub. ft. (9.6 m.³) and with door 6 ft. 4 in. high × 6 ft. wide (1.83 m. × 1.8 m.) in bulkhead. External door on port side of fuselage 4 ft. 10 in. high × 4 ft. wide (1.47 × 1.22 m.) for loading rear compartment.

ACCOMMODATION (Mk. 31E).—Passenger or mixed traffic version. Differs from Mk. 31 by normal installation of full sound-proofing, heating and ventilation and provision of seat, attachment strips pierced at 4 in. (101.6 cm.) intervals to permit wide variety of seating arrangements. Normal seating for 44 passengers (1,030 miles = 1,658 km. range). Movable bulkhead permits various arrangements of mixed passenger/cargo accommodation and



The Bristol Type 170 Mk. 31.

by complete removal of bulkhead hold may be used entirely for cargo. Passenger entry in lobby aft of main hold. Steward's pantry can be fitted in lobby. Passenger's baggage room aft of lobby.

EQUIPMENT.—24-volt electric system. T.K.S. de-icing system. Janitrol 50,000 BTU cabin heaters.

DIMENSIONS.—
Span 108 ft. (32.93 m.).
Length 68 ft. 4 in. (20.80 m.).
Length (Mk. 32) 73 ft. 6 in. (22.42 m.).
Height over fin (rigging position) 26 ft. 3½ in. (8.0 m.).

WEIGHTS AND LOADINGS (Mk. 31 cargo).—
Weight empty 26,910 lb. (12,275 kg.).
Crew (3) 510 lb. (232 kg.).
Oil 396 lb. (180 kg.).
Payload plus fuel 16,184 lb. (7,340 kg.).
Weight loaded 44,000 lb. (19,958 kg.).
Wing loading 29.6 lb./sq. ft. (144.5 kg./m.²).
Power loading 11.0 lb./h.p. (5.0 kg./h.p.).

WEIGHTS AND LOADINGS (Mk. 31E cargo/passenger).—
Weight empty 28,075 lb. (13,022 kg.).
Crew (4) 680 lb. (309 kg.).
Oil 396 lb. (180 kg.).
Payload plus fuel 14,219 lb. (6,448 kg.).
Weight loaded 44,000 lb. (19,958 kg.).
Loadings as above.

WEIGHTS AND LOADINGS (Mk. 31E passenger).—
Weight empty 29,141 lb. (13,218 kg.).
Crew (4) 680 lb. (309 kg.).
Oil 396 lb. (180 kg.).
Payload plus fuel 13,783 lb. (6,251 kg.).
Weight loaded 44,000 lb. (19,958 kg.).
Loadings as above.

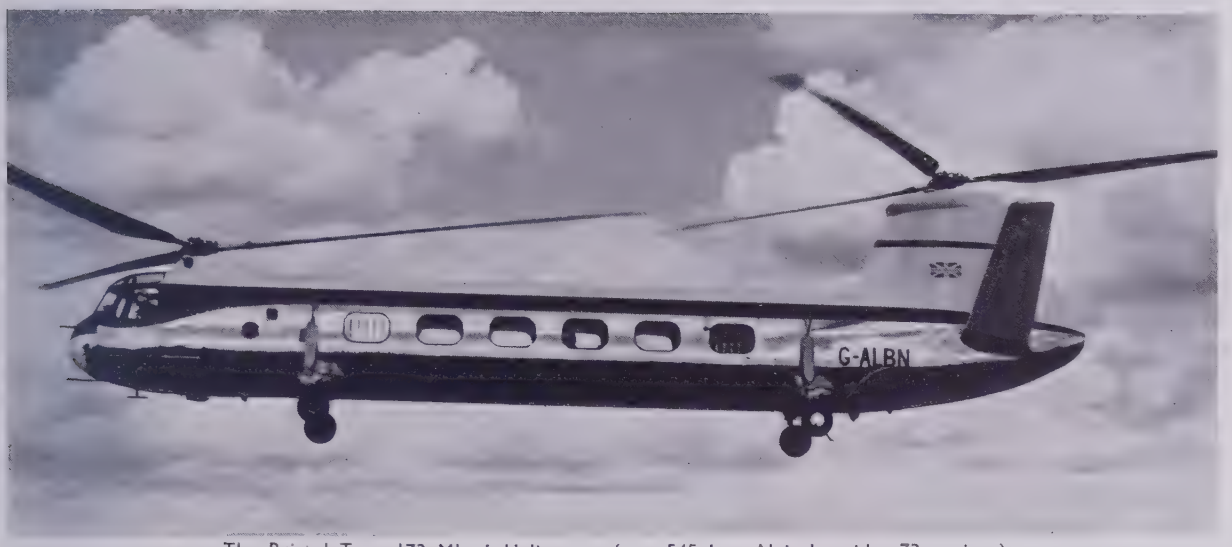
WEIGHTS AND LOADINGS (Mk. 32 cargo/passenger).—
Weight empty 29,435 lb. (13,352 kg.).
Crew (3) 510 lb. (232 kg.).
Oil 396 lb. (180 kg.).
Payload plus fuel 13,659 lb. (6,194 kg.).
Weight loaded 4,400 lb. (19,958 kg.).
Loading as above.

PERFORMANCE (all Marks).—
Max. speed 225 m.p.h. (362 km.h.) at 3,000 ft. (914 m.).
Recommended cruising speed (950 h.p. per engine) 164 m.p.h. (264 km.h.) at 5,000 ft. (1,525 m.).
Climb to 10,000 ft. (3,050 m.) at max. continuous power 10.0 minutes.
Rate of climb on one engine at full loaded weight 250 ft./min. (76.2 m /min).
Service ceiling (at 38,000 lb. = 17,236 kg. loaded weight and max. continuous power) 23,000 ft. (7,010 m.).
Single engine ceiling (at 38,000 lb. = 17,236 kg. loaded weight and emergency climb power) 12,900 ft. (3,477 m.).
Take-off distance to 50 ft. (15.25 m.) 5 m.p.h. wind 2,500 ft. (762 m.).
Landing distance from 50 ft. (5 m.p.h. wind) (15.25 m.) 2,300 ft. (701 m.).

RANGES IN STILL AIR (Mk. 31).—
With 12,000 lb. (5,443 kg.) payload 820 miles (1,320 km.).



The Bristol Type 170 Mk. 32 Freighter, the new long-nosed version now in service with Silver City Airways.



The Bristol Type 173 Mk. 1 Helicopter (two 545 h.p. Alvis Leonides 73 engines).

With 10,000 lb. (4,536 kg.) payload 1,250 miles (2,012 km.).
With 8,000 lb. (3,629 kg.) payload 1,670 miles (2,688 km.).

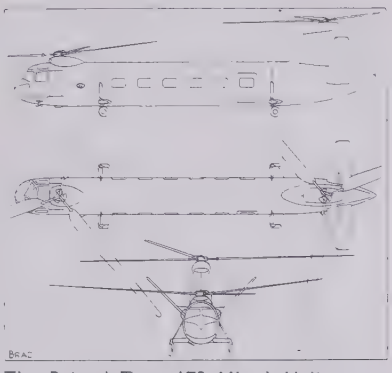
RANGES IN STILL AIR (Mk. 31E cargo/passenger).—
With 16 passengers (with luggage) plus 7,000 lb. (3,170 kg.) freight 780 miles (1,248 m.).
With 16 passengers (with luggage) plus 5,000 lb. (2,268 kg.) freight 1,210 miles (1,936 km.).
With 16 passengers (with luggage) plus 3,000 lb. (1,360 kg.) freight 1,630 miles (2,608 km.).

RANGES IN STILL AIR (Mk. 31E passenger).—
With 32 passengers (with luggage) plus 4,000 lb. (1,814 kg.) freight 650 miles (1,040 km.).
With 32 passengers (with luggage) plus 2,000 lb. (907 kg.) freight 1,080 miles (1,728 km.).

THE BRISTOL TYPE 173.

The Bristol Type 173 is the company's second helicopter design and the first British multi-engine helicopter. The first prototype flew for the first time on January 3, 1952.

The Type 173 uses two similar rotors, one at each end of the fuselage and each driven by its own engine. The rotors and rotor heads are, in fact, essentially similar to those of the Type 171, which



The Bristol Type 173 Mk. 1 Helicopter.

fact should simplify the introduction of the new aircraft into service.

The Type 173 has been developed with close attention to the requirements of British European Airways, who are interested in it for possible future use on internal helicopter services in Great Britain.

The initial production version of the Type 173 will be known as the Mk. 3. Three of these aircraft, now being built, will go into experimental passenger service with B.E.A. The Mk. 3 version will have stub wings fore and aft and will be powered by two 850 h.p. Alvis Leonides Major engines. The all-up weight will be 13,500 lb. (6,130 kg.).

The description which follows refers to the Mk. 1 prototype version.

TYPE.—Sixteen-seat passenger-carrying Helicopter.

ROTOR SYSTEM.—Two three-blade rotors, one on top of forward fuselage, other carried on rear pylon. Rotor blades in prototype are of wooden construction; production aircraft may have metal rotors. Basic blade section NACA 006-0015. Total disc area 3,720 sq. ft. (34.75 m.²).

ROTOR DRIVE.—Each rotor driven by shaft from engine immediately beneath. Rotors are linked by a synchronisation shaft to ensure running at same speed, and to permit one engine to drive both rotors in case of one engine failing. A free wheel and clutch in the drive shaft between each engine and its rotor makes it possible to isolate a dead engine, and provides for full autorotation.

FUSELAGE.—Metal monocoque structure. Front section contains flight deck and is largely panelled with Perspex; next is front engine bay, including fuel and oil and drive to front rotor; then main passenger cabin; and finally, the rear engine bay, together with rear rotor pylon and tailplane.

LANDING GEAR.—Four-wheel fixed type. Track 9 ft. 6 in. (2.9 m.). Wheelbase 26 ft. 5 in. (8.1 m.).

POWER PLANT. Two 525/545 h.p. Alvis



A model of the Bristol Type 173 Mk. 3 Helicopter, to be powered by two 850 h.p. Alvis Leonides Major engines.

Leonides Mk. 73 nine-cylinder radial air-cooled engines mounted with crankshafts vertical. Each engine in steel cowling forming a fireproof box and separate from cabin and pilot's cockpit by soundproof bulkheads.

ACCOMMODATION. Crew of two in forward compartment. Provision for dual control. Crew access doors on each side of nose. Main passenger cabin between two engine bays, with accommodation for 13 passengers. Five individual seats down each side of central sunken aisle, with curved settee for three at rear on starboard opposite main access door in port side. Cabin 26 ft. 2 in. (7.9 m.) × 5 ft. 3 in. (1.60 m.) × 5 ft. 3 in. (1.60 m.), plus 5½ in. (14 cm.) for aisle recess. Six windows each side are jettisonable for emergency exit. Provision for luggage or a small toilet at rear. As a freighter, cabin provides 650 cub. ft. (18.5 m.³) of constant section for cargo stowage.

CONTROLS.—Collective pitch on both rotors operated conjointly by single collective pitch lever in cockpit. Fore and aft control is obtained through control column, by altering differentially the collective pitch of rotors in conjunction with simultaneous cyclic pitch changes, an arrangement permitting greater compensation for c.g. travel than through simultaneous cyclic pitch change alone. Lateral control is by simultaneous change of cyclic pitch and tilting rotor discs laterally. Directional control is by rudder pedals, which produce differential cyclic pitch change and tilt the rotors laterally in opposite directions. Pitching and yawing stability in forward flight provided by a fixed, dihedral tailplane braced to the fuselage. Tailplane area 48 sq. ft. (4.49 m.²).

DIMENSIONS.

Rotor diameter, each 48 ft. 6¾ in. (14.85 m.).
Rotor centres 40 ft. 7¾ in. (12.4 m.).
Overall length (rotors folded) 78 ft. 2 in. (23.8 m.).
Overall width (rotors folded) 17 ft. 0 in. (5.18 m.).
Overall height (rotors folded) 15 ft. 0 in. (4.56 m.).
Height to front hub centre 9 ft. 5¾ in. (2.89 m.).
Height to rear hub centre 14 ft. 0 in. (4.27 m.).

WEIGHTS AND LOADINGS.—

Weight empty 7,824 lb. (3,551 kg.).
Crew (two) 340 lb. (154 kg.).
Fuel and payload 2,346 lb. (1,065 kg.).
Oil 90 lb. (41 kg.).
Weight loaded 10,600 lb. (4,811 kg.).
Disc loading 2.85 lb./sq. ft. (13.9 kg./m.²).
Power loading 9.64 lb./h.p. (4.31 kg./h.p.).

PERFORMANCE (Estimated).—

Max. speed 133 m.p.h. (220 km.h.).
Max. cruising speed (weak mixture) 98 m.p.h. (137 km.h.).

THE BRISTOL TYPE 171 HELICOPTER.
British Military Name: Sycamore.

The Type 171, which first flew in 1947, was the first rotating wing aircraft to be built by the Bristol company. In service as a civil transport and in a number of military and naval rôles, the Type 171 provides accommodation for five persons, including one or two pilots. The standard power-unit is the Alvis Leonides Mk. 73 engine.



The cabin, winch and other details of the Bristol Sycamore H.R. Mk. 50 helicopter.

The current civil versions are :—

Type 171 Mk. 3A. Specially modified version built for B.E.A. passenger services. Incorporates side exhaust, revised instrument panel layout, Decca navigational aids and a re-designed fuselage giving greater luggage space behind engine. Accommodation for four passengers.

Type 171 Mk. 4. Current production version, basically a passenger and freight transport, but capable of rapid conversion for casualty evacuation or search and rescue. The change-over from one version to another can be made in a few minutes, the necessary tools being carried in the helicopter.

From the civil version the following military models have been produced :—

Sycamore H.C. Mk. 10. Primarily an ambulance with accommodation for two standard stretchers carried athwartships at back of cabin, one above the other. Ends of stretchers accommodated by Perspex blisters, one on each side of cabin. Swivel seat for medical attendant.

Sycamore H.C. Mk. 11. Communications, observation and transport version in service with British Army. Standard R.A.F. and Army radio. Rope ladder for use over unsuitable landing terrain. Strong points under fuselage for carrying loads up to 1,600 lb. (726 kg.).

Sycamore H.R. Mk. 12. Search and rescue or communications aircraft in service with R.A.F. Coastal Command.

Sycamore H.R. Mk. 13. Search and rescue or communications aircraft in service with R.A.F. Fighter Command.

Sycamore H.R. Mk. 50. Search and rescue or communications aircraft in service with the Royal Australian Navy. Similar to Mks. 12 and 13. Hydraulically operated winch on starboard side of fuselage. Seats of folding "deck chair" type, to give increased working space for winch operation and rescue work. Open starboard doorway covered by quick-release curtain for rescue missions. In communications rôle winch is removed and starboard door aperture covered by metal panel containing a knock-out Perspex escape hatch. Side exhaust to avoid burning or scorching when landing in scrub or on ship's deck. Modified instrument panel layout. The Mk. 50 was the first version to embody the new landing-gear, now standard in production aircraft, which gives an additional 9 inches ground clearance and raises height of rotor disc during ground running.

The description below refers primarily to the Mk. 4 Civil version which is now in production.

TYPE.—Four or Five-seat Civil or Military Helicopter.

ROTOR SYSTEM.—Three-blade main rotor and three-blade anti-torque rotor. Blades, of Bristol design, of wooden construction with Hydulignum spar along leading-edge, spruce and ply ribs and plywood covering. Two sheet metal tabs, one in vicinity of blade tip and the other near root, correct aerodynamic balance. Blades fully articulated in both flapping and drag planes. Adjustable friction dampers on drag hinges, and spacer rods with rubber buffers between blades. The blades are mounted on tie rods which take the centrifugal force directly in tension



A comparison between the Type 171 Mk. 3 (left) with the original landing-gear and the Sycamore H.R. Mk. 50 with the new standard undercarriage.

but are flexible in torsion. Main portion of blade attached to metal root by series of plates interleaved with spar laminations at one end and a pick-up with two bolts in metal root portion at other. By removing one bolt from each blade it can be folded back and locked for parking purposes. All-metal blades are now being developed.

ROTOR DRIVE.—Drive from engine taken through centrifugal clutch via a vertical shaft to main gear-box below rotor head, which has a two-stage spur reduction gear. From this main gear-box a further drive is taken to shaft which runs down rear fuselage through constant-velocity Hardy Spicer universal joint to a bevel gear-box and so to tail rotor. Free wheel ensures both main and tail rotors will auto-rotate in event of engine failure. Rotor brake above free wheel. Accessories driven from main rotor gear-box, so that they continue to function in event of engine failure.

FUSELAGE.—In three sections, nose, centre and rear. Nose section is metal monocoque with Perspex and metal fairing. Centre-section has welded steel-tube frames with metal skin. Rear section is a metal monocoque.

LANDING GEAR.—Fixed tricycle type with castoring nose-wheel. Pneumatic shock-absorbers to all three wheels. Tail skid aft to prevent damage to tail rotor. Wheel track 9 ft. (2.74 m.).

POWER PLANT.—One 525-545 h.p. Alvis Leonides Mk. 73 nine-cylinder radial air-cooled engine mounted with crankshaft vertical in fuselage centre-section. Engine-driven cooling fan draws air through intake above cabin. Air is ducted from fan past fully-cowled and baffled engine and exhausted through grille at bottom of fuselage centre-section. Steel cowling above cylinders and steel bulkheads below, enclose engine in fireproof box. Graviner spray-ring fire-extinguisher system controllable by pilot. Bag-type fuel cell behind rear engine bulkhead in intermediate fuselage. Normal fuel capacity 65 Imp. gallons (295 litres); with auxiliary tank, 90 Imp. gallons (377 litres). Oil tank above engine on rear engine bulkhead in fuselage centre-section. Total oil capacity 4 Imp. gallons (18.2 litres).



The Bristol Type 171 Mk. 3A Commercial Helicopter.

ACCOMMODATION.—*Search and Rescue*: crew of two with three rear "deck-chair" type seats for rescued personnel. *Ambulance*: pilot and medical orderly and accommodation for two stretcher cases. *Passenger transport, communications, etc.*: four or five persons including crew.

CONTROLS.—Main flying controls consist of a collective-pitch lever, control stick and foot pedals. The collective-pitch lever on the left of the pilot increases or decreases the pitch of the main rotor blades simultaneously, for vertical motion. The control stick varies the cyclic pitch of the blades to give longitudinal and lateral motion. The foot pedals provide directional control and counteract "yaw" by varying the pitch of the tail rotor blades. In addition to the primary controls, a bias gear, operated by handwheels, relieves the load on the control stick, and assists in the longitudinal and lateral trim. A mechanical linkage is provided between the throttle and the collective pitch lever so that the throttle opening is automatically synchronised with increase or decrease of main rotor blade pitch. Over-ride settings of the throttle can be obtained by means of a twist-grip on the pitch lever. The engine clutch is automatic in operation. Full dual control may be provided, but will not normally be fitted.

DIMENSIONS.—
- Main rotor diameter 48 ft. 3.7 in. (14.8 m.).
- Tail rotor diameter 9 ft. 7.3 in. (2.93 m.).
- Length (rotors at extreme positions) 61 ft. 1¼ in. (18.63 m.).
- Length (main rotor folded, tail rotor at min. position) 43 ft. 8 in. (13.4 m.).
- Height (tail rotor in extreme position) 14 ft. 7 in. (4.49 m.).
- Height (tail rotor in min. position) 12 ft. 2 in. (3.71 m.).

WEIGHTS.—
- Basic weight (general purpose) 3,920 lb. (1,780 kg.).
- Basic weight (ambulance rôle) 4,000 lb. (1,816 kg.).
- Basic weight (search and rescue rôle) 4,056 lb. (1,841 kg.).
- All-up weight 5,400 lb. (2,452 kg.).

PERFORMANCE (I.C.A.N. conditions).—
- Max. speed (5 min. rating) (sea level), 132 m.p.h. (214 km.h.) at 287 rotor r.p.m.
- Max. speed (1 hr. rating) (at 2,000 ft. = 610 m.) 123 m.p.h. (198 km.h.) at 269 rotor r.p.m.
- Max. rich mixture cruising speed (at 2,000 ft. = 610 m.) 107 m.p.h. (172 km.h.) at 251 rotor r.p.m.
- Max. economical cruising speed (at 2,000 ft. = 610 m.) 91 m.p.h. (146 km.h.) at 242 rotor r.p.m.
- Max. vertical rate of climb (sea level) 180 ft./min. (55 m./min.).
- Max. climb at forward speed (5 min. power, sea level), 920 ft./min. at 60 m.p.h. I.A.S. (280 m./min. at 96 km.h.).
- Service ceiling 16,000 ft. (5,180 m.).
- Hovering ceiling (without ground effect) 5,200 ft. (1,580 m.).
- Max. still air range at normal load, 268 miles (430 km.).
- Max. still air range with auxiliary tank (total fuel 90 Imp. gal. = 377 litres) 372 miles (595 km.).



The Bristol Sycamore H.R. Mk. 13 Military Helicopter.

DE HAVILLAND

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The de Havilland Aircraft Company Limited was founded at Stag Lane, Edgware, in September, 1920, although the origins of the company go back to 1908 when Geoffrey de Havilland designed and built his first aeroplane. Divisions of the company for production of Gipsy engines and variable-pitch airscrews were formed in 1928 and 1935, and overseas companies were formed in 1927 (Australia), 1928 (Canada), 1929 (India), 1930 (South Africa) and 1939 (New Zealand).

Developed during the war, but too late to see operational service, the Vampire single-seat jet fighter has since become the most widely-adopted fighter in the world. It is now in service in fifteen countries. Among other achievements, the Vampire was the first jet aircraft to land on and take-off from an aircraft-carrier.



The D.H. Vampire T. Mk. 11 Trainer (D.H. Goblin turbojet engine).

Later development of the basic Vampire led to the N.F. Mk. 10, a two-seat radar-equipped night-fighter; the T. Mk. 11 side-by-side all-purpose jet trainer; and the Venom, an advanced day, night and naval fighter powered by the larger and more powerful D.H. Ghost engine. The latest de Havilland fighter is the D.H. 110, a two-seat day and night all-weather fighter powered by two Rolls-Royce Avon engines.

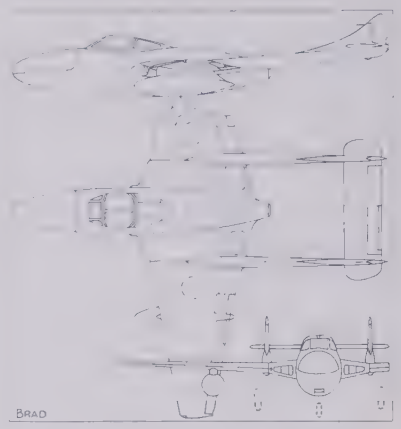
Post-war civil production began with the Dove light transport, over 450 of which have been built. This was followed in 1950 by the four-engined Heron feeder-liner, which is now in full production.

The company's most important undertaking in the civil field has, however, been with the Comet jet airliner. Within three years of the maiden flight of the prototype in July, 1949, the Series 1 Comet entered regular service with the British Overseas Airways Corporation on May 2, 1952, and deliveries of the improved Series 1A Comet to U.A.T., the R.C.A.F. and Air France were being completed at the end of June, 1953. A longer range development, the Comet Series 2, is now in full production and a prototype of the 58 76-passenger Comet Series 3 is under construction. Comets are now being built in three plants—at Hatfield and Chester, and in the Short Bros. and Harland factory at Belfast. Production of the Comet 3 is expected to be at the rate of 70 per year by 1958.

Current production, in addition to the Comet, include the Venom and Sea Venom, Vampire, Vampire Trainer, Dove, Heron and Chipmunk.

Details of the products of the Australian and Canadian de Havilland companies may be found in the "Australia" and "Canada" sections respectively.

The products of the de Havilland Engine Co., Ltd. and the Airspeed Division are to be found under their separate headings elsewhere in this volume.



The D.H. Vampire Trainer.

THE D.H. 115 VAMPIRE TRAINER.

Development of a trainer version of the Vampire jet fighter was undertaken by the de Havilland company as a private venture. The Vampire Trainer is unusual among modern advanced trainers in having side-by-side seating for instructor and pupil. It is now in service in the Royal Air Force as the Vampire T. Mk. 11, as well as with ten other air forces. For details of the Trainer variants see under "Vampire."

The cabin is pressurized to a differential of 3 lb./sq. in., and is entered through a rearward-opening hood. All essential cockpit instruments and controls are duplicated. The crew are provided with Martin Baker ejector seats, the Trainer being the first British-built Vampire to be so equipped.

The nose-cap also hinges up to give access to certain equipment located in the forward fuselage, including a ciné-gun, radio, batteries and oxygen bottles. The normal Vampire armament of four 20 mm. cannon is retained in the fuselage belly.

Actual detail design of the Vampire Trainer was undertaken by the Airspeed Division, at whose Christchurch works the prototype was built. The first flight of the prototype was made on November 15, 1950.

DIMENSIONS.—
Span 38 ft. 0 in. (11.59 m.).
Length 34 ft. 7 in. (10.55 m.).
Wing area 262 sq. ft. (24.4 m.²).

WEIGHTS.—
Weight loaded (clean) 11,350 lb. (5,130 kg.).
Weight loaded (with two 100 Imp. gal. (455 litre) drop tanks) 13,100 lb. (5,950 kg.).

PERFORMANCE (Clean).—
Max. speed at S/L 538 m.p.h. (864 km.h.).
Max. speed at 20,000 ft. (6,100 m.) 548 m.p.h. (880 km.h.).
Max. speed at 40,000 ft. (12,200 m.) 520 m.p.h. (836 km.h.).
Initial rate of climb 4,500 ft./min. (22.8 m./sec.).
Climb to 20,000 ft. (6,100 m.) 5.6 min.
Climb to 40,000 ft. (12,200 m.) 16.3 min.
Still air range 632 miles (1,017 km.) at 300 m.p.h. (482 km.h.) at 20,000 ft. (6,100 m.) and 920 miles (1,480 km.) at 403 m.p.h. (648 km.h.) at 40,000 ft. (12,200 m.).
Take-off run 600 yds. (549 m.).
Landing run 700 yds. (640 m.).
Limiting Mach. No. at high altitudes 0.815.

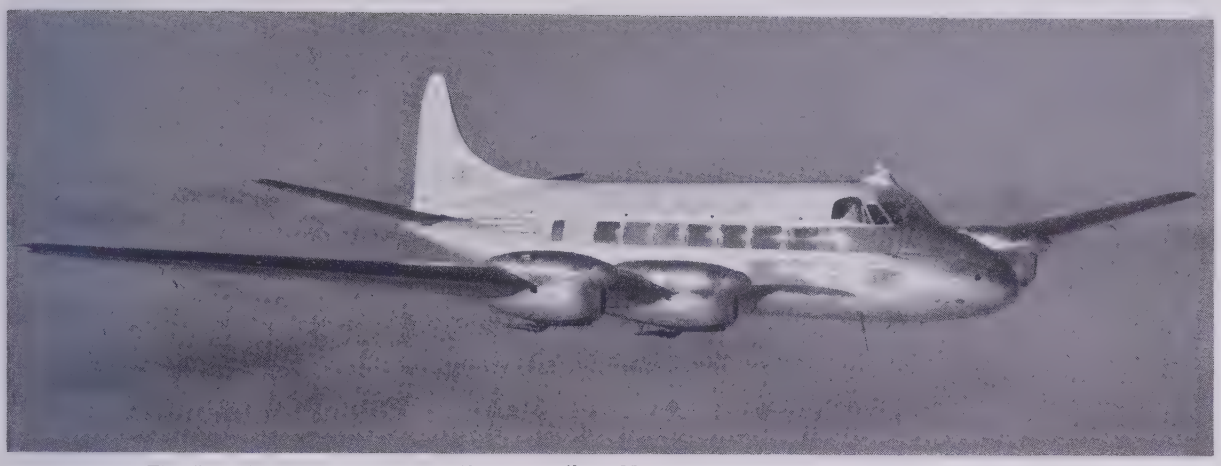
THE D.H. 114 HERON.

The Heron is the latest addition to the long line of successful de Havilland light transports. Powered by four 250 h.p. ungeared and unsupercharged Gipsy Queen 30 engines, it is now in service in seven countries. The standard Heron carries 14-17 passengers but an 8-seat executive model is also available. The Heron has good take-off capabilities and a short landing run and is suited to operation from small airfields.

The Heron is available in two versions, the Series 1 with a fixed tricycle landing-gear, and the Series 2 with a retractable tricycle landing-gear. While the Series 1 Heron benefits by the simplicity and low weight of the fixed landing-gear and



The D.H. Heron Series 1 Light Transport (four 250 h.p. D.H. Gipsy Queen 30 Mk. 2 engines).



The D.H. Heron Series 2 Light Transport (four 250 h.p. D.H. Gipsy Queen 30 Mk. 2 engines).

is more economical on the shorter stage-lengths, the Series 2 shows to better advantage on the longer stage-lengths where the saving in fuel due to the lower drag more than balances the extra weight of the retracting gear.

TYPE.—Four-engined Feeder-line Transport.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 10.5. Light alloy structure with light alloy sheet skin. Goodyear pulsating-boot leading-edge de-icing. Ailerons in outer wing panels and trailing-edge flaps inboard in three pieces each side. Ailerons and flaps have metal frames and fabric covering. Flaps pneumatically-operated. Gross wing area 487 sq. ft. (45.2 m.²).

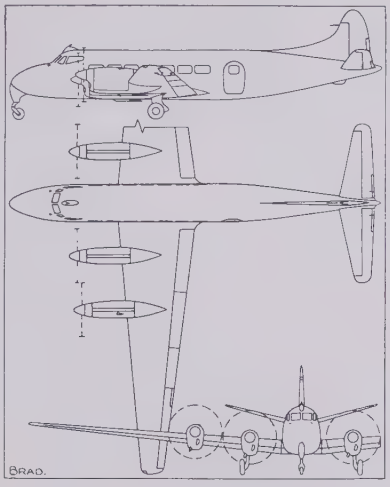
FUSELAGE.—Light alloy monocoque structure. Wing centre-section spar integral with fuselage. Main cabin floor of sandwich construction, stressed for freight carrying.

TAIL UNIT.—Cantilever monoplane type. Metal frames with fixed surfaces metal-covered and movable surfaces fabric-covered. Tailplane span 21 ft. 0 in. (6.4 m.).

LANDING GEAR.—Fixed (Series 1) or retractable (Series 2) tricycle type. Retractable type is pneumatically-operated. In both types of landing-gear each main leg has rubber shock absorbers. Nosewheel has an oleo-pneumatic shock-absorber and is castoring and self-centering. Pneumatic brake operation. Track 15 ft. 4 in. (4.68 m.).

POWER PLANT.—Four 250 h.p. D.H. Gipsy Queen 30 Mk. 2 six-cylinder in-line air-cooled direct-drive unsupercharged engines. All engines on their bearers are interchangeable. D.H. 2/1000/2 bracket-type constant-speed two-blade airscrews, diameter 7 ft. (2.14 m.). Bag-type fuel tanks in each wing root, inboard of inner engines. Maximum fuel capacity 316 Imp. gallons (1,435 litres).

ACCOMMODATION.—Crew of two side-by-side in separate cockpit forward. Main passenger accommodation normally arranged for fourteen passengers in single seats each side of central aisle, with toilet at rear. Total cabin capacity 475 cub. ft. (13.45 m.³). Luggage bay at rear, capacity 85 cub. ft. (2.41 m.³). Alternative accommodation for fifteen passengers, with smaller toilet compartment and rear luggage bay capacity



The D.H. Heron Series 1.

50 cub. ft. (1.42 m.³), or for 17 passengers with no toilet and rear luggage bay capacity 25 cub. ft. (0.707 m.³). In each arrangement there is a front luggage compartment, capacity 26 cub. ft. (0.736 m.³). Entrance at rear on port side. Headroom in cabin 5 ft. 8½ in. (1.77 m.).

EQUIPMENT.—Full radio, including Marconi AD97/108 transmitter-receiver, Marconi AD7092 or AD7092A Automatic Radio Compass, and Standard STR9X V.H.F. Provision for Marconi blind-approach equipment, standard STR12 V.H.F. or Murphy MR60B V.H.F. radio, and Sperry ALIA autopilot.

DIMENSIONS.—
- Span 71 ft. 6 in. (21.8 m.).
- Length 48 ft. 6 in. (14.8 m.).
- Height 15 ft. 7 in. (4.75 m.).

WEIGHTS (Series 1—fixed L/G.).—
- Tare weight (including radio) 7,985 lb. (3,623 kg.).
- Crew (2) 330 lb. (150 kg.).
- Fuel (201 Imp. gal. = 913 litres) 1,445 lb. (655 kg.).
- Oil (18.1 Imp. gal. = 82.3 litres) 162 lb. (73 kg.).
- Payload (including 14 passengers) 3,078 lb. (1,396 kg.).
- Weight loaded 13,000 lb. (5,897 kg.).

WEIGHTS (Series 2—retractable L/G.).—
- Tare weight (including radio) 8,150 lb. (3,697 kg.).
- Crew (2) 330 lb. (150 kg.).
- Fuel (183 Imp. gal. = 832 litres) 1,320 lb. (599 kg.).
- Oil (16.3 Imp. gal. = 74.1 litres) 146 lb. (66 kg.).
- Payload 3,054 lb. (1,385 kg.).
- Weight loaded 13,000 lb. (5,897 kg.).

PERFORMANCE (Series 1).—
- Cruising speed at 8,000 ft. (3,440 m.) at 65% METO power 165 m.p.h. (266 km.h.).
- Weak mixture cruising at 3,000 ft. (915 m.) 174 m.p.h. (280 km.h.).
- Rate of climb at S/L. 1,060 ft./min. (5,37 m./sec.).
- Rate of climb at S/L. on three engines 550 ft./min. (2.78 m./sec.).
- T.O. distance to 50 ft. (15.2 m.), hard runway, airline method 750 yds. (685 m.).
- T.O. distance to 50 ft. (15.2 m.) with one engine cut at safety speed 865 yds. (790 m.).
- Landing distance from 50 ft. (15.2 m.) 665 yds. (610 m.).

PERFORMANCE (Series 2).—
- Cruising speed at 8,000 ft. (2,440 m.) at 65% METO power 183 m.p.h. (295 km.h.).
- Weak mixture cruise at 3,000 ft. (915 m.) 191 m.p.h. (307 km.h.).
- Rate of climb at S/L. 1,140 ft./min. (5.79 m./sec.).
- Rate of climb at S/L. on three engines 610 ft./min. (3.11 m./sec.).
- T.O. and landing distances similar to Series 1.

THE D.H. 112 VENOM.

The Venom is a straightforward development of the Vampire designed to accommodate the de Havilland Ghost engine, and with aerodynamic refinements to enable the aircraft to take full advantage of the increased power.

The nacelle and tail assembly are substantially similar to Vampire components and are built on the same jigs. The wing, however, is entirely new, and is a square-tipped unit of very thin section, carrying jettisonable long-range tanks



The D.H. Venom F.B. Mk. 1 Single-seat Fighter Bomber (D.H. Ghost turbojet engine).



The D.H. Sea Venom N.F. Mk. 20 Naval Day and Night Fighter (D.H. Ghost turbojet engine).

at the extreme tips. The tanks are designed to be retained in combat. The thin-section wing has necessitated a new design of undercarriage, and new wheels of larger diameter and thin section, with single-disc hydraulic brakes, have been introduced.

The following are the principal current versions of the Venom :—

Venom F.B. Mk. 1. Day fighter and fighter-bomber for the R.A.F. Provision for bombs or rockets beneath wings, or two long-range fuel tanks, in addition to wing-tip tanks. First flight at Hatfield on September 2, 1949.

Venom N.F. Mk. 2. Two-seat night and all-weather fighter for the R.A.F., seating two side-by-side and carrying radar in lengthened nose.

Venom N.F. Mk. 3. Development of N.F. Mk. 2 fitted with special combat equipment.

Sea Venom N.F. Mk. 20. Naval version of the Venom N.F. Mk. 2, in production for the Royal Navy as a two-seat day and night fighter. Fitted with power-folding wings, catapult gear and arrester gear.

Sea Venom N.F. Mk. 21. Improved Mk. 20. Latest electronic equipment, improved controls and new clear-view canopy.

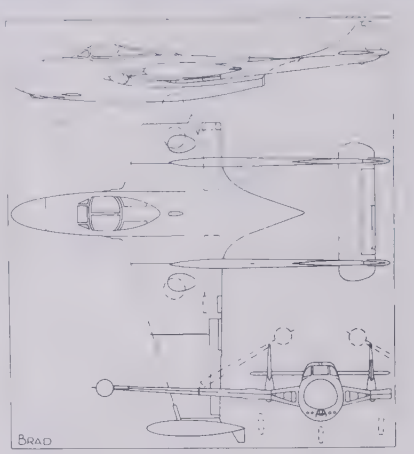
Venom F.B. Mk. 50. Export version of F.B. Mk. I.

Venom N.F. Mk. 51. Export version of N.F. Mk. 2 for Swedish Air Force.

Sea Venom N.F. Mk. 52. Export version of N.F. Mk. 20.

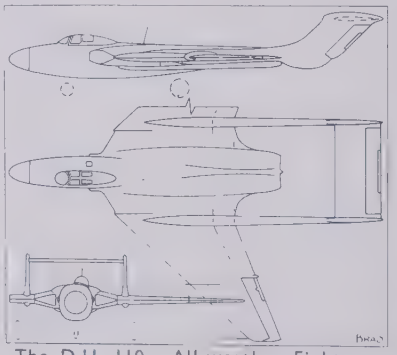
In addition to being in production for the R.A.F., Royal Navy and the Royal Australian Navy, the Venom is being built under licence in Switzerland, and the Sea Venom in France.

DIMENSIONS.—
Span 41 ft 9 in. (12.75 m.).



The D.H. Sea Venom N.F. Mk. 21

Length (Mk. 1) 31 ft. 10 in. (9.7 m.).
Length (Mk. 2 and 20) 35 ft. 3 in. (10.7 m.).
WEIGHTS AND PERFORMANCE.—
No data available.



The D.H. 110. All-weather Fighter.

THE D.H. 110.

The D.H. 110 is a two-seat day and night all-weather fighter which is being developed for the Royal Navy. It is powered by two Rolls-Royce Avon turbojet engines and is equipped with the latest electronic combat and navigational aids. No further details of this aircraft are available for publication.

DIMENSIONS.—
Span 51 ft. (15.5 m.).
Length 52 ft. 1½ in. (15.9 m.).

THE D.H. 106 COMET.

The Comet jet airliner, conceived in 1946 and first flown in 1949, opened the World's first jet passenger services with the British Overseas Airways Corporation on May 2, 1952. Since that date Series 1A Comets have gone into service with the Union Aéromaritime de Transport (U.A.T.), Air France, and with the Royal Canadian Air Force. The production of the early version the Series I and 1A Comets has now given place to the more powerful Series 2 which will go into service with B.O.A.C. in 1954. Work on the first Comet 3 is well advanced and flight trials are due to begin during the Summer of 1954.

Brief identification details of the three series of Comets are given below.

Series 1. Four D.H. Ghost 50 turbojet engines (5,050 lb.=2,290 kg. s.t. each). First prototype flew on July 27, 1949, and first production aircraft on January 1, 1950. First Series 1 Comet handed over to B.O.A.C. on February 4, 1951, six months ahead of schedule, and the last of nine aircraft on September 30, 1952, more than fifteen months ahead of schedule. 36 passengers. Fuel capacity 6,000 Imp. gallons (27,276 litres). A.U.W. 105,000 lb. (45,540 kg.).

Series 1A. Four D.H. Ghost 50 Mk. 2 turbojet engines with water/methanol injection. Fuel capacity increased to 7,000 Imp. gallons (31,750 litres), all in



The D.H. 110 two-seat All-weather Fighter (two Rolls-Royce Avon turbojet engines).



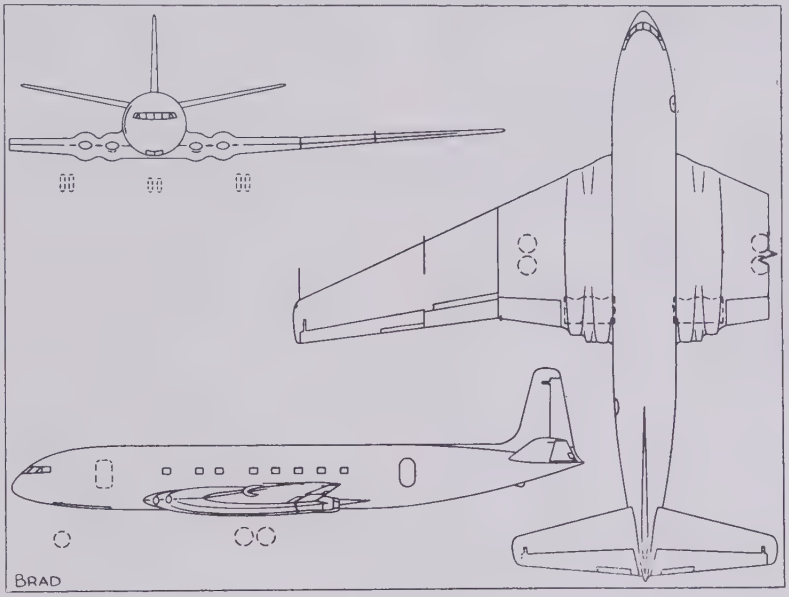
The D.H. Comet Series I Airliner (four D.H. Ghost turbojet engines).

wings, to increase stage lengths by some 20 per cent. 44 passengers. First Series 1A flew in August, 1952. A.U.W. 115,000 lb. (52,164 kg.). To Air France (3), Union Aéromaritime de Transport (3), Royal Canadian Air Force (2).

Series 2. Four Rolls-Royce Avon turbojet engines (6,500 lb.=2,950 kg. s.t. each). Fuselage lengthened by 3 feet forward of wings. Capacity payload with 44 passengers on stages up to 2,500 miles (4,000 km.). A.U.W. 120,000 lb. (54,432 kg.). A Comet 1 airframe (6th built) fitted with Avon engines, to serve as prototype for Series 2, first flew on February 16, 1952. Series 2 Comets ordered by B.O.A.C. (11), British Commonwealth Pacific Airlines (3), Linea Aeropostal Venezolana (2), Panair do Brasil (4), Japan Air Lines (2), Air France (3).

Series 3. Four Rolls-Royce RA.16 turbojet engines (9,000 lb.=4,082 kg. s.t. each). Fuselage lengthened by 18 feet. 58/76 passengers. Fuel capacity 8,000 Imp. gallons (36,368 litres). Allowing for reserves for climb, descent, headwinds, stand-off and diversions, practical stage length will be 60% greater than for Series 1. A.U.W. 145,000 lb. 65,772 kg.). Series 3 Comets ordered by B.O.A.C. (10), Pan American World Airways (3 plus 7 option), Panair do Brasil (2), Air India International (2).

The stage lengths with capacity payload and fuel reserves for which the Comet 1 and 1A are suited cover routes of from 1,500 to 1,750 miles; the Comet 2 is designed for stages of up to 2,000 miles and the Comet 3 for stages of up to 2,500 miles. The cruising speed of the Comet 3 will be 500 m.p.h. (800 km.h.) while the cruising speeds of the Comet 2 and Comet 1 are slightly less.



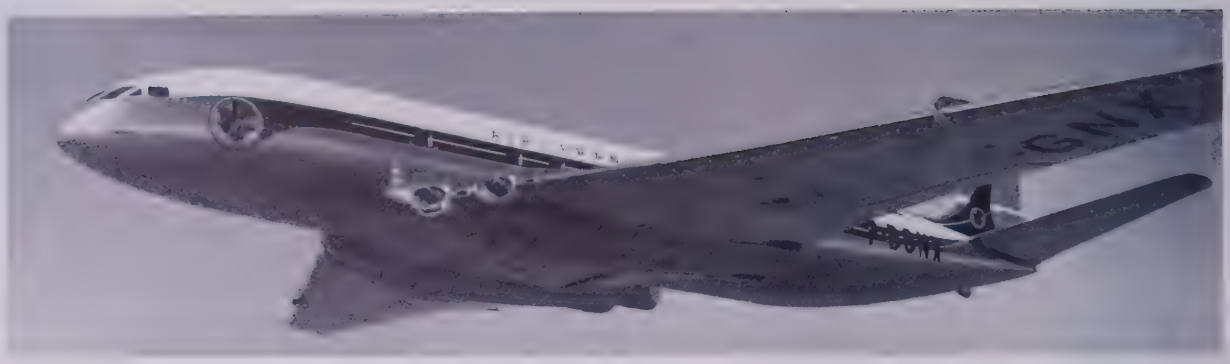
The D.H. 106 Comet Series I and IA Airliners.

At the end of the first year of jet airline operation in the history of air travel, B.O.A.C.'s fleet of Comets was flying 122,000 revenue miles each week.

Some 28,000 passengers travelled by Comet during the first twelve months of operation, and 104,600,000 revenue passenger-miles were flown. The appeal of jet travel, which has a smoothness and comfort unrivalled by any other vehicle, has proved to be considerable. Passengers embarking at London Airport now



The D.H. Comet Series I Airliner (four D.H. Ghost turbojet engines).



The D.H. Comet Series IA Airliner (four D.H. Ghost turbojet engines).

reach Tokio in 36 hours as compared with 86 hours by piston-engined airliners, and times to South Africa, Ceylon and Singapore have been correspondingly reduced.

The year's operating figures showed that B.O.A.C.'s fleet of eight Comets, operating at an overall load factor of 80 per cent., yielded sufficient profit to cover interest on capital expenditure. The costing calculation, which was as applied to the Corporation's other fleets, took into account the cost of route-proving and training flights spread over the life of the aircraft.

The Comet services operated by U.A.T. started on February 19, 1953, with the opening of a twice-weekly service from Paris to Dakar by way of Casablanca. A weekly service connecting Paris with Brazzaville was opened on May 11 and further extensions in Africa and to the Far East are now planned.

The years 1953 and 1954 will see the introduction of the Comet 2, with its improved revenue-earning ability, and in 1956 the 58/76-passenger Comet 3, which will do proportionally better, will enter service.

Details of the Comet's main features and performance released to date are set out below.

Type.—Four-engined Medium-range Jet Airliner.

Wings.—Low-wing cantilever monoplane with moderate sweepback, with two Ghost engines accommodated in each stubwing, passing through the front and rear spar webs. Integral fuel tanks and thermal de-icing. Air brakes are fitted. Plain flaps outboard of the engines and split flaps inboard, with hydraulic operation. Extensive use of Redux metal-to-metal bonding. Chord (all Series) 29 ft. 6 in. (9.0 m.) at root, 6 ft. 9 in. (2.06 m.) at tip. Gross wing area (Series 1, 1A and 2) 2,015 sq. ft. (187.2 m.²).

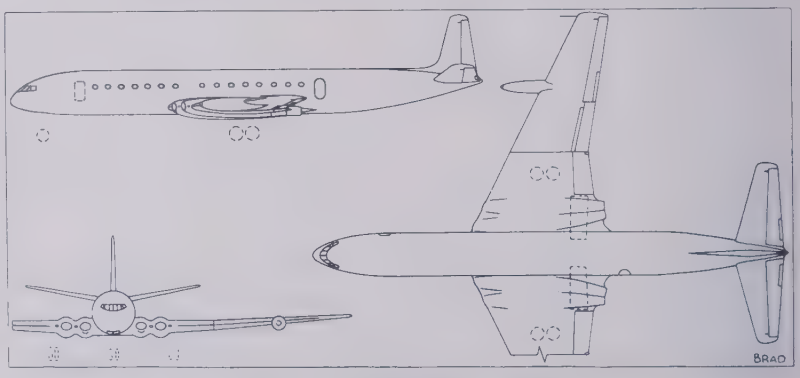
Fuselage.—Of circular cross section, 10 ft. (3.05 m.) in diameter throughout length of cabin. A pressure dome seals the aft end of the cabin. Redux bonding used extensively.

Tail Unit.—Cantilever monoplane tailplane and single fin and rudder. Main fin insulated from the stub, to contain the H.F. aerial. V.H.F. and I.L.S. aerials are housed in di-electric tips and fin and tailplane. Tailplane span Series 1, 1A and 2 42 ft. 8 in. (12.0 m.), Series 3 47 ft. 5 in. (14.45 m.).

Landing Gear.—Retractable tricycle type of de Havilland design. Each main unit carries a four-wheel bogie retracting outwards into wings. Doors retract when undercarriage is down. Twin-wheel nose unit is steerable and retracts backwards into fuselage. Hydraulic retraction. Wheel track (shock-strut centres) Series 1, 1A and 2 28 ft. 5 in. (8.66 m.), Series 3 28 ft. 2 in. (8.58 m.). Wheel base (shock-strut centres) Series 1 and 1A 31 ft. 11 in. (9.73 m.), Series 2 34 ft. 11 in. (10.64 m.), Series 3 46 ft. 8 in. (14.22 m.).

Power Plant.—Four de Havilland Ghost 50 (5,050 lb. = 2,290 kg. s.t. each) (Series 1), or Ghost 50 Mk. 2 with water/methanol injection (5,050 lb. = 2,290 kg. s.t. each) (Series 1A), or Rolls-Royce Avon 501 (6,500 lb. = 2,950 kg. s.t. each) (Series 2), or Rolls-Royce Avon RA.16 (9,000 lb. = 4,082 kg. s.t. each) (Series 3). Hinged panels below wings expose whole installations for easy servicing from ground. Quickly-detachable air intake and tail pipe connections and special disconnect-joints in engine control connecting rods. Installation is split into three temperature zones, each zone being separated by fire-proof bulkhead and having its own ventilators and fire-extinguishing system. Fuel in integral wing tanks and flexible bag tanks in centre-section, with pressure refuelling. Series 3 will also have projecting leading-edge tanks. Fuel capacities: Series 1 6,000 Imp. gallons (27,336 litres), Series 1A and 2 7,000 Imp. gallons (31,750 litres), Series 3 8,000 Imp. gallons (36,368 litres).

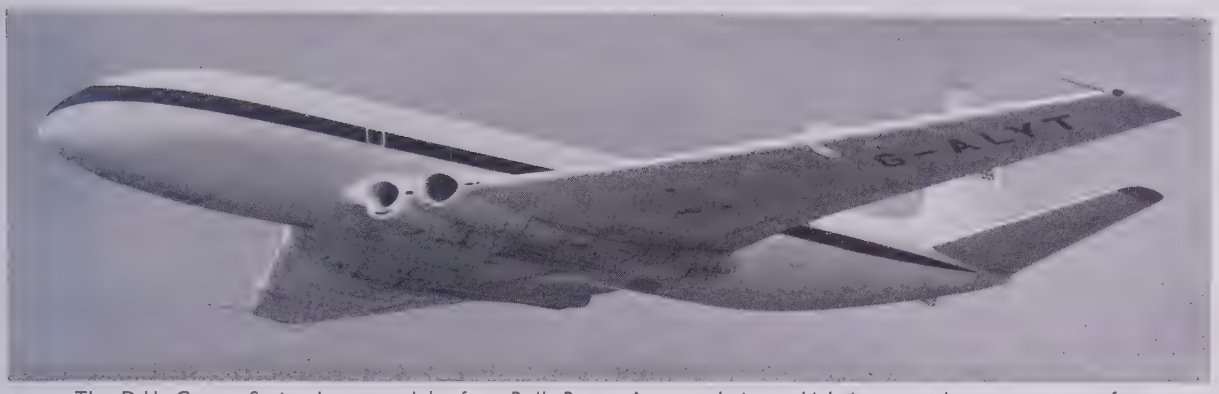
Accommodation.—Flight deck forward, with accommodation for two pilots with full dual control, flight engineer, and radio-operator/navigator. Seating capacities: Series 1 36 passengers, Series 1A and 2 44 passengers, Series 3 58/76 passengers. Flight deck, cabin and freight compartments pressurised to 8¼ lb./sq. in. (0.58 kg./cm.²) by air tapped from the engine compressors, giving a cabin altitude of 8,000 ft. (2,436 m.) when the aircraft is at 40,000 ft. (12,120 m.). Series 3 will be pressurised to a slightly higher figure. All versions have galley and adequate toilet, wardroom and dressing amenities. Main passenger door in port side at end of cabin, and crew door, forward in starboard side; both open inwards and measure 4 ft. 8 in. × 2 ft. 6 in. (1.43 m. × 0.761 m.). Freight capacities: rear hold floor Series 1, 75 cub. ft. (2.123 m.³) Series 3 155 cub. ft. (4.387 m.³); rear hold (under floor) Series 1, 1A and 2 185



The D.H. Comet Series 3 Airliner.



A drawing of the D.H. Comet Series 3 Airliner (four Rolls-Royce Avon turbojet engines).



The D.H. Comet Series 1 powered by four Rolls-Royce Avon turbojets which has served as a prototype for the Series 2 Comet.

cub. ft. (5.236 m.³), Series 3 240 cub. ft. (6.792 m.³); front hold (above floor) Series 1 and 1A 200 cub. ft. (5.660 m.³), Series 2 212 cub. ft. (6.0 m.³) port, 34 cub. ft. (0.962 m.³) starboard; front hold (below floor) Series 3 150 cub. ft. (4.245 m.³).

DIMENSIONS.—
Span (all Series) 115 ft. (35 m.).
Length (Series 1 and 1A 93 ft. (28.35 m.).
Length (Series 2) 96 ft. (29.26 m.).
Length (Series 3) 111 ft. 6 in. (33.99 m.).
Height (on ground—over fin) (all Series) 28 ft. 4½ in. (8.65 m.).

WEIGHTS (Series 1).—
Capacity payload 12,500 lb. (5,670 kg.).
Loaded weight 105,000 lb. (45,540 kg.).

WEIGHTS (Series 1A).—
Capacity payload 12,670 lb. (5,747 kg.).
Loaded weight 115,000 lb. (52,164 kg.).

WEIGHTS (Series 2).—
Capacity payload 13,500 lb. (6,123 kg.).
Weight loaded 120,000 lb. (54,432 kg.).

WEIGHTS (Series 3).
Capacity payload (58-seater) 17,365 lb. (7,877 kg.).
Capacity payload (76-seater) 20,000 lb. (9,072 kg.).
Weight loaded 145,000 lb. (65,772 kg.).

PERFORMANCE.—
Cruising speed (Series 1, 1A and 2) 490 m.p.h. (790 km.h.).
Cruising speed (Series 3) 500 m.p.h. (800 km.h.).

THE D.H. 104 DOVE.

Over 450 Dove light transports are now operating in a variety of rôles all over the World. The standard commercial model has accommodation for eight/eleven passengers, but variants have been designed for survey, pest-control and ambulance duties.

The basic versions of the Dove are as follows :—

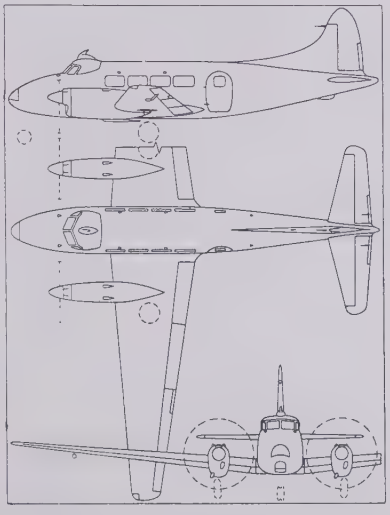
Series 1. Standard 8/11-seater. Two 340 h.p. D.H. Gipsy Queen 70 engines. A.U.W. 8,500 lb. (3,855 kg.).

Series 2. Same as Series 1 but with special executive interior furnishings.

Series 3. Design study only.

Series 4. R.A.F. Devon C. Mk. 1. Military modification of the 8-passenger Series 1.

Series 5. Two 380 h.p. D.H. Gipsy Queen 70 Mk. 2 engines. Installation of this engine requires no modifications to the standard Dove engine bearer structure, pipe lines and control runs. Twenty per cent. increase in pay-load over 500 mile (800 km.) stage as compared with Series 1. A.U.W. 8,800 lb. (3,996 kg.).



The D.H. Dove Light Transport.

Series 6. Same as Series 5 but with special executive interior.

There is also a convertible version of the Dove, which can serve as a fully-equipped navigational radio trainer, air mapping trainer or survey aircraft, 13-seat light personnel transport or as an ambulance.

TYPE.—Twin-engined eight/eleven-passenger Light Transport.

WINGS.—Cantilever low-wing monoplane. Piercy aerofoil section, max. thickness at 35% chord. Root chord 8 ft. 8 in. (2.64 m.); tip chord 2 ft. 6½ in. (.77 m.); aspect ratio 9.7; incidence 2 degrees, dihedral (top front spar) 4 degrees. All-metal structure with stressed aluminium-alloy Redux-bonded skin riveted to spars and ribs. Mass-balanced aluminium-alloy ailerons. Trim-tab in each, adjustable on ground only. Pneumatically-operated plain-hinge flaps in two sections each side. Total aileron area 10.9 sq. ft. (1 m.²). Total flap area 19.8 sq. ft. (1.84 m.²). Gross wing area 335 sq. ft. (31.12 m.²).

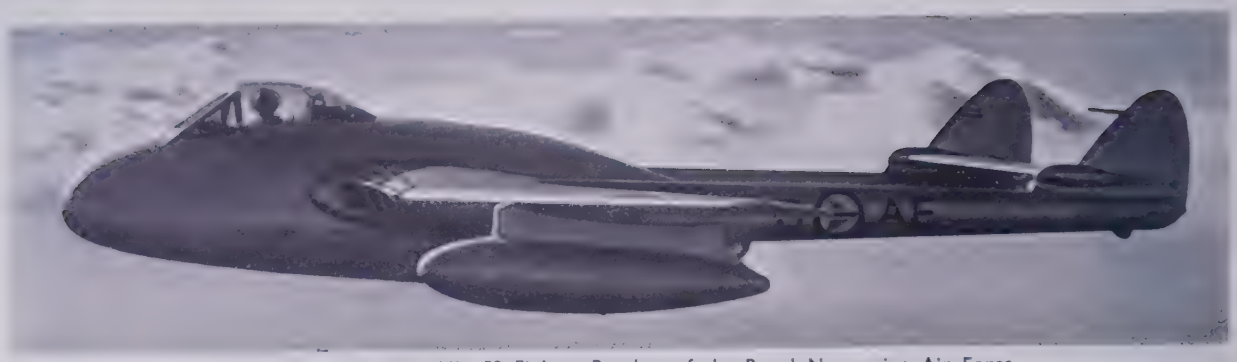
FUSELAGE.—Oval-section monocoque structure with Redux-bonded stressed aluminium-alloy skin.

TAIL UNIT.—Cantilever monoplane type. Light-alloy structure with metal-covered fixed surfaces and fabric-covered elevators and rudder. Tailplane adjustable for incidence on ground. Elevators interchangeable left and right. Controllable metal trim-tabs in rudder and elevators. Fin area 20.4 sq. ft. (1.89 m.²). Rudder area 13.75 sq. ft. (1.27 m.²). Tailplane area 35.46 sq. ft. (3.28 m.²). Elevator area (total) 24.5 sq. ft. (2.27 m.²).

LANDING GEAR.—Retractable tricycle type. Rubber-in-compression shock-absorber legs interchangeable left and right. Dunlop wheels, tyres and brakes. Nose-wheel on Lockheed air-oil shock-absorber strut. Dunlop nose-wheel with Marstrand two-track tyre. Pneumatic retraction, with mechanical emergency lowering gear. Track 13 ft. 9 in. (4.19 m.). Wheel base 13 ft. 0 in. (3.96 m.).



The D.H. Dove Series 5 Light Transport (two 380 h.p. D.H. Gipsy Queen 70 Mk. 2 engines).



A D.H. Vampire F.B. Mk. 52 Fighter Bomber of the Royal Norwegian Air Force.

POWER PLANT.—Two de Havilland Gipsy Queen 70 Mk. 2 geared and supercharged six-cylinder in-line inverted air-cooled engines rated at 355 b.h.p. at 4,250 ft. (1,296 m.) and with 380 b.h.p. available for take-off. Engines complete with oil tank and all accessories form self-contained units which are quickly detachable and interchangeable right and left. D.H. Hydromatic 1,000 three-blade constant-speed feathering and braking airscrews 7 ft. 5 in. (2.26 m.) diameter. Total fuel capacity 130 Imp. gallons (591.5 litres).

ACCOMMODATION.—Enclosed cockpit seating pilot and co-pilot/radio-operator side-by-side with dual controls. Main cabin, ventilated and sound-proofed, has accommodation for eight passengers in four seats on each side of central aisle. Main entry door, 2 ft. 3 in. (0.68 m.) from ground on port side aft of rear cabin bulkhead, with another door into cabin. Toilet on starboard side of vestibule opposite main entry door. Rear cabin bulkhead and lavatory can be removed to provide a ninth passenger seat. In eleven-passenger version bulkhead aft of vestibule removed and two further seats installed. Main cabin 11 ft. 9 in. long × 5 ft. 2½ in. wide × 4 ft. 6 in. high (3.58 m. × 1.58 m. × 1.37 m.). Volume 246 cub. ft. (6.96 m.³). Two emergency exits in roof. Forward luggage compartment under floor of cockpit with volume of 22 cub. ft. (0.62 m.³). Max. load 300 lb. (136 kg.). Aft luggage compartment (on eight-nine seat aircraft) with volume of 45 cub. ft. (1.27 m.³). Max. load 600 lb. (272 kg.). On eleven-seat aircraft 22 cub. ft. (0.62 m.³) luggage space available aft of rear seats.

DIMENSIONS.
- Span 57 ft. 0 in. (17.37 m.).
- Length 39 ft. 3 in. (11.96 m.).
- Height (over rudder) 13 ft. 4 in. (4.06 m.).
- Height (over cockpit canopy) 8 ft. 10 in. (2.69 m.).

WEIGHTS AND LOADINGS (Series 5 and 6).—
- Weight empty (equipped) 5,725 lb. (2,597 kg.).
- Crew (2) 330 lb. (150 kg.).
- Fuel (for 400 miles = 645 km.) 845 lb. (383 kg.).
- Oil 84 lb. (38 kg.).
- Payload 1,816 lb. (824 kg.).
- Weight loaded 8,800 lb. (3,992 kg.).
- Wing loading 26.27 lb./sq. ft. (129.19 kg./m.²).
- Power loading 11.58 lb./h.p. (5.26 kg. h.p.).

PERFORMANCE (Series 5 and 6).-
- Max. weak mixture cruising speed 202 m.p.h. (325 km.h.).
- Cruising speed at 60% M.E.T.O. power 179 m.p.h. (288 km.h.).
- Rate of climb at sea level 920 ft./min. (4.67 m./sec.).
- Rate of climb on one engine at M.E.T.O. power 220 ft./min. (1.12 m./sec.).
- Range with 1,500 lb. (680 kg.) payload without extra tanks 695 miles (1,118 km.).
- Take-off distance to 50 ft. (15 m.) 810 yds. (740 m.).
- Landing distance from 50 ft. (15 m.) 655 yds. (600 m.).
- Fuel consumption at cruising speed 27.3 Imp. gallons per hour (124 litres per hour) (6.55 m.p.g. = 2.32 km. per litre).
- Fuel consumption at max. weak mixture cruising speed 35 Imp. gallons per hour (159 litres per hour) (5.77 m.p.g. = 2.04 km. per litre).

THE D.H. 100 VAMPIRE.

At the beginning of 1953, the Vampire was in service in no less than 15 different countries. Vampires of various marks built in Britain were in service with or in production for the R.A.F. (Mks. 1, 3, 5, 9, 10 and 11), the Royal Navy (Mks. 20 and 22), the R.C.A.F. (Mk. 3), the R.N.Z.A.F. (Mk. 5), the Royal Norwegian (Mks. 3, 52 and 55), Royal Swedish (Mks. 1 and 50), Egyptian (Mk. 5), South African (Mk. 5), Indian (Mk. 3), Swiss (Mks. 1 and 6), French (Mks. 3, 5 and 53), Italian (Mk. 5 and Mk. 54), Venezuelan (Mk. 5 and 55), Finnish (Mk. 52) and Portuguese (Mk. 55) Air Forces. The Vampire is also being produced under licence in four countries—Switzerland, France, Italy and India.

A number of different versions of the Vampire have been developed for the R.A.F. and foreign Air Forces. Brief details of these appear below.

Vampire F. Mk. 1. D.H. Goblin 2 engine (Goblin 1 in first 40 aircraft). Single-seat Fighter. After the first 50 the production Mk. 1 was fitted with pressurised cockpit with one-piece bubble canopy, increased wing fuel tankage and airship-type drop tanks as for Mk. 3. Seventy delivered to Sweden (1st Contract) in 1946-47. Four supplied to Switzerland. Production complete.

Vampire Mk. 2. Rolls-Royce Nene 1 engine. Three Mk. 1 airframes so fitted. Similar externally to Mk. 1 but fitted with two additional air scoops above nacelle to deliver air to the rear side of the double-sided compressor of the Nene engine.

Vampire F. Mk. 3. D.H. Goblin 2 engine. Long-range version of the Mk. 1. Identified in later production versions by a re-designed tail-unit. Three additional flexible fuel tanks in each outer wing giving an additional capacity of 128 Imp. gallons (582 litres). Former metal centre-section tanks changed to Marflex bag tanks. External fuel carried in two 100 or 200-gallon (455 or 910-litre) airship-type drop tanks. First flight of Mk. 3 on November 4, 1946. Eighty-five supplied to R.C.A.F. Four supplied to Norway.

Vampire Mk. 4. Rolls-Royce Nene engine. Intended to be the production version of the Mk. 2. Not built in England but developed into Mk. 30 for Australian production.

Vampire F.B. Mk. 5. D.H. Goblin 2 engine. Ground attack fighter for the R.A.F. Span reduced to 38 ft. (11.6 m.) by squared tips. Long-stroke (Naval pattern) landing-gear, and strengthened wing to carry external war load, which may include 8 rockets and two 500 lb. (226 kg.) bombs or two 100 gallon (455 litre) drop tanks, or two 1,000 lb. (452 kg.) bombs without rockets.

Vampire F.B. Mk. 6. D.H. Goblin 3 engine. Export fighter. Similar structurally to Mark 5, but increased thrust of the Goblin 3 engine (3,300 lb. = 1,500 kg.) improves performance at all levels. Supplied to Switzerland and built in that country under licence.

Vampire F.B. Mk. 9. D.H. Goblin 2 engine. A version of the Vampire F.B. Mk. 5 produced in limited quantities for tropical use. Has a Godfrey refrigeration unit in mainplane providing cabin refrigeration, de-misting, de-icing, etc.

Vampire N.F. Mk. 10. D.H. Goblin engine. Two-seat radar-equipped night fighter. In service in R.A.F. and Italian Air Force (Mk. 54).

Vampire T. Mk. 11. D.H. Goblin 3 engine. Two-seat side-by-side Trainer. Fitted with Martin-Baker ejector seats.



A D.H. Vampire F.B. Mk. 5 Single-seat Fighter Bomber as supplied to the Venezuelan Air Force.



The D.H. Vampire N.F. Mk. 10 Night Fighter (D.H. Goblin turbojet engine).

Later production aircraft have clear-vision semi-frameless cockpit hood and dorsal fin extensions. See under D.H. 115 for further details.

Sea Vampire F. Mk. 20. D.H. Goblin 2 engine. Vampire Mk. 5 wings strengthened to take both acceleration and heavier landing loads. Areas of dive brakes and landing flaps increased by 35% and 40% respectively. A-type arrestor hook hinged to end ribs of wing roots and when stowed is faired into nacelle above jet-pipe.

Sea Vampire 21. Experimental development of Mk. 20 for deck-landing experiments with undercarriage-less aircraft in conjunction with specially-prepared rubberised deck surfaces.

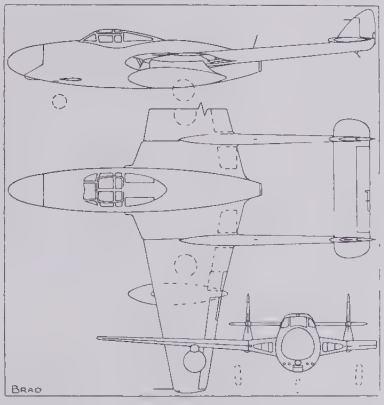
Sea Vampire T. Mk. 22. Naval version of T. Mk. 11 for armament and advanced handling training.

Vampire F.B. Mk. 30. Version of the F.B. Mk. 5 built by D.H. Australia for R.A.A.F. Fitted with the Australian-built Rolls-Royce Nene engine and has the "elephant-ear" intakes used in the Mk. 2.

Vampire F.B. Mk. 50. D.H. Goblin 3 engine. Export fighter similar to Mk. 6. In service in Sweden (2nd and 3rd contracts). Fitted with the Swedish-built Goblin engine.

Vampire F.B. Mk. 51. Version of the F.B. Mk. 5 originally planned for production in France by the S.N.C.A.S.E. and to be fitted with the Hispano-Suiza Nene engine. Developed into Vampire 53.

Vampire F.B. Mk. 52. D.H. Goblin 3 engine. Export fighter similar to Mk. 6.



The D.H. Vampire N.F. Mk. 10.

In service in the Royal Norwegian Air Force. Also supplied to Finland. Fitted with British-built Goblin engine.

Vampire F.B. Mk. 53. Hispano Suiza Nene engine. In production in France by the S.N.C.A.S.E. The design makes provision for the use of French materials, instruments and equipment, including a French ejector seat. Named "Mistral" in France.

Vampire N.F. Mk. 54. Export version of N.F. Mk. 10 two-seat Night Fighter.

Vampire T. Mk. 55. Export version of T. Mk. 11 two-seat Trainer.

TYPE.—Single-seat jet-propelled twin-boom Fighter.

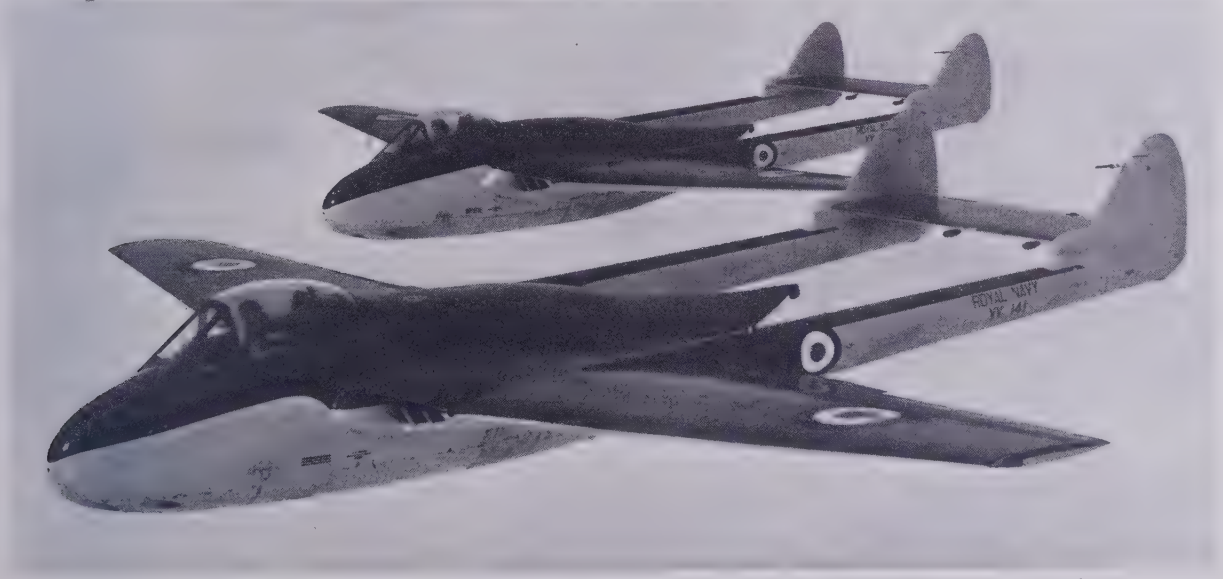
WINGS.—Cantilever mid-wing monoplane. Aerofoil section of E.C. 1240 series. Aspect ratio 6.2. All-metal structure with flush-riveted Alclad skin. All-metal mass-balanced ailerons with metal covering. Inset trim-tabs adjustable on ground only. Aileron area (each) 7.7 sq. ft. (.71 m.²). Hydraulically-operated all-metal split flaps on either side of tail-booms, used in conjunction with air-brake between ailerons and flaps. Flap area (total) 20.8 sq. ft. (1.93 m.²). Air-brakes move backward and rotate so as to present flat surface to slipstream disposed equally above and below wing. Air-brake area (each) 2.96 sq. ft. (.27 m.²). Gross wing area 262 sq. ft. (28.2 m.²).

NACELLE. — Composite structure. Main nacelle member is heavy transverse aluminium-alloy bulkhead of circular section in line with main wing-spar, which carries forward portion of nacelle in front and jet unit behind. Nose-piece back to cockpit front armour is monocoque structure with plywood and balsa sandwich skin.

TAIL BOOMS.—All-metal structures of elliptical section with Alclad covering,

TAIL UNIT.—All-metal cantilever structure. Twin fins and rudders mounted above tail booms with constant-chord tailplane and single elevator between. Internally mass-balanced rudders and externally mass-balanced elevator. Controllable trim-tab in elevator. Rudder tabs adjustable on ground only. Chord 2 ft. 10 in. (0.86 m.), area 26.5 sq. ft. (2.46 m.²). Elevator area (with tab) 10.5 sq. ft. (0.978 m.²). Elevator movement 19 degrees 2 minutes up, 12 degrees 48 minutes down. Fin area (each) 5.58 sq. ft. (.517 m.²). Rudder area (each, with tab) 3.31 sq. ft. (0.307 m.²). Rudder movement 25 degrees each way.

LANDING GEAR.—Retractable tricycle type. Hydraulic operation. Oleo-pneumatic shock-absorber struts. Pneumatic braking system. Two-tread nose-wheel tyre. Faired emergency bumper skid under rear



Two D.H. Sea Vampire F. Mk. 20 Single-seat Shipboard Fighters (D.H. Goblin turbojet engines).

of each boom. Track 11 ft. 3 in. (3.43 m.) Wheel base 11 ft. 3 in. (3.43 m.).

POWER PLANT.—One de Havilland Goblin centrifugal-flow turbojet engine rated at 3,300 lb. (1,500 kg.) s.t. Air intakes in wing leading-edge each side of nacelle, and circular jet outlet in extreme rear of nacelle. Main fuel tank of 96 Imp. gallons (436 litres) in nacelle ahead of bulkhead and behind pilot. Two 53 Imp. gallon (241 litre) tanks in wing one on each side of nacelle and six outer wing tanks totalling 128 Imp. gallons (582.4 litres). Two 100 Imp. gallon (455 litre) airship-type drop-tanks under wings, outboard of landing-gear.

ACCOMMODATION.—Pilot's pressurized cockpit ahead of wing leading-edge. Bullet-proof windscreen and sliding blister-type canopy. Both screen and canopy of double-skinned Perspex with silicagell drying cells between. Marshall cabin blower. Max. cabin pressure 2¾ lb./sq. in. (.193 kg./cm.²). Blower intakes in wing leading-edge outside jet intakes. Cabin intake in nose. Armour plating in front of and behind pilot.

ARMAMENT.—Four 20 mm. British Hispano cannon in nacelle below floor of cockpit firing through apertures two on each side of nose-wheel. Magazines (600 rounds) in fuselage behind pilot. Provision for one 1,000 lb. (454 kg.) bomb under each wing in place of long-range fuel tanks.

EQUIPMENT. — 24-volt electrical system. I.F.F. radio, two radio units, cine-camera, de-icing, oxygen, etc.

DIMENSIONS (F.B. Mk. 5 and F.B. Mk. 6).—
Span 38 ft. 0 in. (11.6 m.).
Length 30 ft. 9 in. (9.37 m.).
Height 6 ft. 2 in. (1.9 m.).
Wing area 262 sq. ft. (24.2 m.²).

WEIGHTS AND LOADINGS (F.B. Mk. 5).—
Weight empty 7,253 lb. (3,310 kg.).
Normal combat weight 10,513 lb. (4,769 kg.).
All-up weight (external tanks) 12,263 lb. (5,563 kg.).
All-up weight (rockets and bombs) 12,353 lb. (5,603 kg.).

WEIGHTS AND LOADINGS (F.B. Mk. 6).—
Weight empty 7,389 lb. (3,351 kg.).
Combat weight 10,620 lb. (4,818 kg.).
Max. loaded weight (full external war load) 12,402 lb. (5,652 kg.).
Wing loading (at 12,300 lb. = 5,579 kg. A.U.W.) 47 lb./sq. ft. (229 kg./m.²).

PERFORMANCE (F.B Mk. 5).—
Max. level speed 531 m.p.h. (855 km.h.).
Rate of climb 4,250 ft./min. (21.6 m./sec.) at sea level, 3,000 ft./min. (15.2 m./sec.) at 10,000 ft. (3,050 m.) 2,200 ft./min. (11.2 m./sec.) at 20,000 ft. (6,100 m.), 1,550 ft./min. (7.9 m./sec.) at 30,000 ft. (9,150 m.) 750 ft./min. (3.8 m./sec.) at 40,000 ft. (12,200 m.).
Still air range at 350 m.p.h. (555 km.h.) 590 miles (950 km.) at sea level, or 1,145 miles (1,840 km.) at 30,000 ft. (9,150 m.).
Take-off to clear 50 ft. (15 m.) at full load 1,210 yds. (1,100 m.).
Landing from 50 ft. (16.3 m.) at 8,500 lb. (3,850 kg.) 1,100 yds. (1,005 m.).
Patrol duration (with allowance for climb and 15 minutes combat) 2 hrs. at 220 m.p.h. (370 km.h.) at sea level, or 2.35 hrs. at 350 m.p.h. (555 km.h.) at 30,000 ft. (9,150 m.).

PERFORMANCE (F.B. Mk. 6).—
Max. level speed 548 m.p.h. (883 km.h.).
Rate of climb 4,900 ft./min. (24.9 m./sec.) at sea level 3,700 ft./min. (19.3 m./sec.) at 10,000 ft. (3,050 m.), 2,800 ft./min. (14.2 m./sec.) at 20,000 ft. (6,100 m.), 2,050 ft./min. (10.4 m./sec.) at 30,000 ft. (9,150 m.) 1,175 ft./min. (6 m./sec.) at 40,000 ft. (12,200 m.).
Still air range at 350 m.p.h. (555 km.h.) 620 miles (1,000 km.) at sea level, 1,220 miles (1,960 km.) at 30,000 ft. (9,150 m.).
Take-off to clear 50 ft. (16.3 m.) 1,040 yds. (1,140 m.).
Patrol duration (with allowance for climb and 15 minutes combat) 2 hrs. at 220 m.p.h. (370 km.h.) at sea level, or 2.45 hrs. at 350 m.p.h. (555 km.h.) at 30,000 ft. (9,150 m.).



The D.H.C.1 Chipmunk T. Mk. 10 (145 h.p. D.H. Gipsy Major 8 engine).

THE D.H.C. 1 CHIPMUNK.

The Chipmunk, which was designed and built by the de Havilland Aircraft of Canada, Ltd., has been selected to replace the Tiger Moth as the standard primary trainer in all R.A.F. Volunteer Reserve flying schools and it is now in production in England.

The military Chipmunk T. Mk. 10 and Mk. 20 are powered by the Gipsy Major 8 engine and the civil Chipmunk Mk. 21 is fitted with the Gipsy Major 10 Mk. 2.

TYPE.—Two-seat Basic Trainer.

WINGS.—Cantilever all-metal low-wing monoplane. Pitot head-on port wing, whip aerial on starboard. Gross wing area 172 sq. ft. (15.98 m.²).

FUSELAGE.—All-metal semi-monocoque in two sections.

TAIL UNIT.—Ground adjustable tab on rudder, Bowden-operated trim-tab on starboard elevator only. Dorsal fin integral with rear fuselage, incorporating top rail for sliding cockpit canopy. Tailplane area 17 sq. ft. (1.58 m.²). Elevator area 14 sq. ft. (1.3 m.²). Fin area 5.9 sq. ft. (0.55 m.²). Rudder Area 6.8 sq. ft. (0.63 m.²).

LANDING GEAR.—Fixed cantilever rubber-in-compression shock struts carry Dunlop wheels with single-disc hydraulic brakes. Castoring tail-wheel. Landing and taxying light is installed in top of port leg fairing.

POWER PLANT.—One 145 h.p. de Havilland Gipsy Major 8 four-cylinder inverted air-cooled unsupercharged engine, with fixed-pitch metal Fairey-Reed airscrew, diameter 6 ft. 10 in. (2.1 m.). Cartridge starter, generator and vacuum pump. One fuel tank in each wing root, capacity 9 Imp. gallons (41 litres) each.

ACCOMMODATION.—Tandem cockpits for pupil and instructor with all controls and instruments fully duplicated. Full standard blind flying panels. V.H.F. (S.T.R.9) radio and intercomm. Common sliding canopy covers both cockpits. Windscreen frame re-inforced as crash pylon. Bucket seats fitted with Z-type safety harness. Removable and sliding amber screens are fitted for synthetic night training.

DIMENSIONS.—
Span 34 ft. 4 in. (10.46 m.).
Length 25 ft. 5 in. (7.75 m.).
Height 7 ft. 0 in. (2.13 m.).

WEIGHTS (T. Mk. 10 and Mk. 20).—
Weight empty 1,425 lb. (647 kg.).
Crew (2) with parachutes 400 lb. (182 kg.).
Fuel (full tanks) 130 lb. (59 kg.).
Oil 23 lb. (10 kg.).
Removable load 36 lb. (16 kg.).
Normal loaded weight 2,014 lb. (914 kg.).
Max. permissible A.U.W. 2,100 lb. (953 kg.).

WEIGHTS (Civil Mk. 21).—
Weight empty 1,430 lb. (649 kg.).
Crew (2) with parachute 400 lb. (182 kg.).
Fuel (full tanks) 173 lb. (78 kg.).
Oil 23 lb. (10 kg.).
Removable load 30 lb. (14 kg.).
Normal loaded weight 2,056 lb. (933 kg.).
Max. permissible A.U.W. 2,100 lb. (953 kg.).

PERFORMANCE (at 2,100 lb. = 953 kg. A.U.W.).—
Max. speed at S/L. 138 m.p.h. (222 km.h.).
Cruising speed at S/L. 119 m.p.h. (191 km.h.).
Rate of climb at S/L. 840 ft./min. (4.27 m./sec.).
Service ceiling 15,800 ft. (4,820 m.).
Range at 116 m.p.h. = 187 km.h. at 5,000 ft. = 1,525 m. with allowance for T.O. and climb Mks. 10 and 20 280 miles (445 km.), Mk. 21 380 miles (610 km.).
Endurance at 5,000 ft. (1,525 m.) Mks. 10 and 20 2.3 hrs., Mk. 21 3.2 hrs.

ENGLISH ELECTRIC

THE ENGLISH ELECTRIC COMPANY LTD.

HEAD OFFICE: QUEEN'S HOUSE, KINGSWAY, LONDON, W.C.2.

WORKS, AIRCRAFT DIVISION: PRESTON, LANCS.

Directors: Sir George H. Nelson, F.C.G.I., M.I.Mech.E., M.I.E.E. (Chairman and Managing Director), H. G. Nelson, A.M.I.C.E., A.I.Mech.E., A.M.I.E.E. (Deputy Managing Director), Colonel Sir Geoffrey H. Cox, C.B.E., T.D., D.L., Sir Edward Crowe, K.C.M.G., Brig-General Wade H. Hayes, O.B.E., P. Horsfall, Dr. C. P. Snow, C.B.E., Ph.D., Sir Edward Wilshaw, K.C.M.G., Sir John Woods, G.C.B., M.V.O., Lord Caldecote, D.F.C. and Godfrey Phillips.

Chief Designer and Chief Engineer, Aircraft Division: F. W. Page, B.A., F.R.Ae.S.

The English Electric Co., Ltd. was formed in 1918 by the amalgamation of Dick Kerr & Co., Ltd., of Preston; the Coventry Ordnance Works, Ltd., of Coventry; the Phoenix Dynamo Manufacturing Co., Ltd., of Bradford; Willans & Robinson, Ltd., of Rugby; and the Siemens Dynamo Works of Stafford. The first three companies mentioned had had considerable experience in aircraft design and construction, dating back in the case of the Coventry Ordnance Works to 1911. Dick Kerr and Phoenix Dynamo between them were the largest producers of seaplanes and flying-boats in World War I.

The then newly-formed English Electric Co., Ltd., retained an aircraft department, actually a legacy from the Phoenix Dynamo Manufacturing Co., Ltd., and continued to design and build flying-boats of its own design. Owing, however, to lack of Government support in the form of orders this department was closed down in March, 1926.

Aircraft manufacture was resumed at Preston in 1938 when production of the Handley Page Hampden was undertaken, and this was followed by the Halifax. In all, 850 Hampdens and 2,145 Halifaxes were built by English Electric. English Electric also undertook the first production of the D.H. Vampire in April, 1944, because of the preoccupation of the de Havilland company with other important work in the latter part of the war.

After the war, English Electric elected to remain in the Aircraft Industry and established its own technical and design organization. The first aircraft of English Electric design since 1926, is the Canberra twin-jet bomber, which is now in large-scale production for the Royal Air Force, by English Electric, A. V. Roe & Co., Ltd., Handley Page, Ltd. and Short Bros. & Harland, Ltd.

The Canberra is also in production at the Australian Government factory at Fishermen's Bend, Melbourne, Victoria, for the R.A.A.F. The first Australian-built Canberra B. Mk. 20 flew for the first time on May 29, 1953.



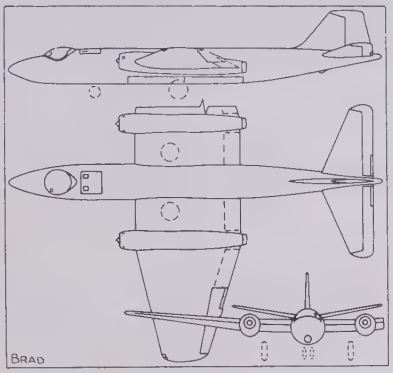
The English Electric Canberra B. Mk. 2 Medium Bomber (two Rolls-Royce Avon turbojet engines).

The Canberra is also in production in the United States in a modified night-intruder form, by the Glenn L. Martin Company, Baltimore, Md. under the U.S.A.F. designation B-57A. This version is powered by two Wright J65 Sapphire turbojets. The first Martin B-57A made its first flight on July 20, 1953.

Many notable flights have been made by the Canberra in the course of which seven point-to-point records have been established, including the first two-way crossing of the Atlantic in one day (10 hours 3 mins.) and both the East-West (4 hours 18 mins.) and West-East (3 hours 25 mins.) trans-Atlantic records. A Canberra set up a new England-Australia record in May, 1952, covering the distance of 10,000 miles in a flying time of 19 hours 10 mins. at an average speed of 523 m.p.h. (838.6 km.h.). This was the third successive record set up by a Canberra over this route. Other point-to-point records include London-Karachi (8 hours 52 mins.), London-Nairobi (9 hours 55 mins.), and London-Tripoli (2 hours 41 mins.).

During October-December, 1952, four Canberras of R.A.F. Bomber Command, led by Air Vice-Marshal D. A. Boyle, visited fourteen countries in Latin America and the Caribbean. The South Atlantic was crossed twice and, in all, 24,000 miles (38,400 km.) were covered in a flying time of 50 hours, representing an average speed of 479 m.p.h. (766.4 km.h.) for the four aircraft.

On May 4, 1953, a Canberra powered by two Bristol Olympus turbojet engines established a new World's Height Record for aircraft at 63,668 ft. (19,418 m.).



The English Electric Canberra B. Mk. 5.

THE ENGLISH ELECTRIC A.1 CANBERRA. Designed to Specification B.3/45, the Canberra is powered by two Rolls-Royce Avon axial-flow turbojet engines. The first prototype (VN799) flew for the first time on May 13, 1949. Deliveries of the first production Canberras to the Royal Air Force began in January, 1951.

Canberra B. Mk. 1. This designation refers only to the first four aircraft built. These were two-seat medium bombers, with "solid" nose. The second aircraft had Rolls-Royce Nene engines for experimental flying, the other three being powered by Rolls-Royce Avons with electric starters.

Canberra B. Mk. 2. Two Rolls-Royce Avon 1 engines, with cartridge-operated turbo-starters. Three-seat medium bomber, with transparent nose cone. Cabin pressurisation from engine compressors in place of two-stage blower on Mk. 1. Crew consists of pilot, navigator/plotter and observer, the two latter being trained navigators. Former navigates by radar on to target, latter acts as bomb-aimer over target. Radio is pilot-operated. First production version.

Canberra P.R. Mk. 3. Similar to the B. Mk. 2 but carries equipment for high altitude photographic reconnaissance, and lacks the offset bomb-aiming panel in the transparent nose cap. Length 66 ft. 8 in. (20.3 m.).

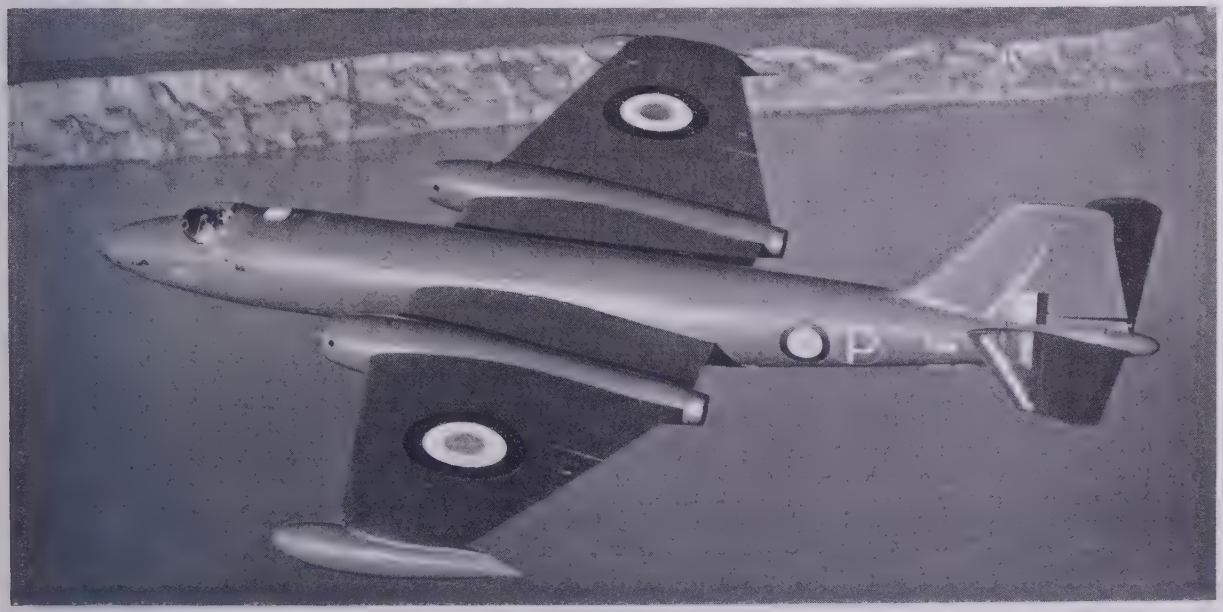
Canberra T. Mk. 4. Trainer version of B. Mk. 2. Crew of three comprising a pupil and instructor seated side-by-side with dual controls and a navigator behind.

Canberra B. Mk. 5. Target marker version of B. Mk. 2. Solid nose with large optically-flat bomb-aimer's panel beneath nose.

Canberra B. Mk. 6. Production version of the B. Mk. 5.

Canberra P.R. Mk. 7. Production version of the P.R. Mk. 3.

Canberra B. Mk. 20. Tactical bomber built in Australia by the Government Aircraft Factory, Fishermen's Bend, Melbourne, and modified to meet R.A.A.F. operational requirements. Powered by two Rolls-Royce Avon engines manufactured in Australia by Commonwealth Aircraft Corpn. First B. Mk. 20 flew for the first time on May 29, 1953. Mks. 21-24 reserved for further Australian developments.



The English Electric Canberra P.R. Mk. 3 Photographic Reconnaissance monoplane (two Rolls-Royce Avon turbojet engines).



The English Electric Canberra T. Mk. 4 Trainer (two Rolls-Royce Avon turbojet engines).

TYPE.—High-altitude Medium Bomber.

WINGS.—Cantilever mid-wing monoplane. Symmetrical high-speed aerofoil. Dihedral, inner wing (to engine nacelle) 2°, outer wing 4° 21′. Root chord 19 ft. (5.8 m.). Tip chord 7 ft. 8 in. (2.34 m.). Sweepback on leading-edge (outer wing) 13 degrees, 53 minutes. Sweepforward on trailing-edge (outer wing) 19 degrees 53 minutes. All-metal single-spar structure with continuous main spar through fuselage. Irving-Westland pressure-balanced ailerons with spring-tabs in each. Four hydraulically-operated split trailing-edge flaps. "Finger-tip" type air brakes in top and bottom wing surfaces. Gross wing area 960 sq. ft. (89 m.²).

FUSELAGE.—All-metal semi-monocoque structure. Pressure bulkhead at rear of cockpit. Centre fuselage divided horizontally, with bomb-bay in lower compartment. Bomb doors, hydraulically-operated with remote selection, fitted with rollers which slide in curved tracks to retract into fuselage. All controls, pipe-lines and wires are jointed at the main fuselage transport joints to permit an easy break-down into major components. Maximum fuselage diameter 6 ft. (1.83 m.). Minimum ground clearance 2 ft. 0.25 in. (0.615 m.).

TAIL UNIT.—Cantilever monoplane tailplane with dihedral and single fin and rudder. All-metal structure. Variable incidence tailplane hinged at its leading-edge and operated by an English Electric actuator in the rear fuselage. Spring trim-tabs in port elevators. Mass-balanced rudder with spring trim-tabs. Tailplane span 27 ft. 4.9 in. (8.35 m.). Tailplane and elevator area 71.22 sq. ft. (6.62 m.²). Tailplane centre-line chord 10 ft. (3.05 m.). Tailplane tip-chord 4 ft. (1.22 m.). Tailplane dihedral 10 degrees. Fin and rudder root chord (less dorsal fin) 12 ft. 8.5 in. (3.9 m.). Fin and rudder tip chord 5 ft. 0.55 in. (1.54 m.).

LANDING GEAR.—Retractable nose-wheel type. Each main unit, of English Electric design, is an oleo-pneumatic shock-absorber strut carrying a single wheel inboard on a cantilever stub axle. Dowty lever-suspension liquid-spring nose unit with twin wheels. Hydraulic retraction. Track 15 ft. 5 in. (4.7 m.).

POWER PLANT.—Two Rolls-Royce Avon axial-flow turbojet engines. Each engine carried in wing nacelle on four self-aligning mounting points, and completely accommodated forward of main spar, through which jet-pipe passes. Removable panels for installation of engine above and below nacelle, and servicing panel under forward end. Oil cooling radiator buried in wings outboard of nacelles. Flame detectors and a fire extinguishing system are fitted. Cartridge-fired turbine starter. Main fuel stowage in centre fuselage. Provision for auxiliary wing-tip tanks.

ACCOMMODATION (B. Mk. 2).—Crew of three, comprising pilot, navigator/plotter and observer, all provided with ejector seats. Pilot seated off-centre to port under large double-layer Perspex canopy, navigator further aft to starboard and observer behind pilot. Large crew escape hatch aft of canopy with two roof-lights. Transparent nose fairing with a visual sighting panel for the bomb-aimer. Cabin pressurisation by air supply from engine compressors. System operates automatically above 10,000 ft. (3,050 m.) and pressurizes to a differential of 3.5 lb./sq. in. (0.248 kg./m.²). Emergency oxygen system. Crew entry through an upward-hingeing door in fuselage starboard side.

DIMENSIONS.—
Span 63 ft. 11½ in. (19.5 m.).
Length 65 ft. 6 in. (20 m.).
Height over fin 15 ft. 7 in. (4.75 m.).

WEIGHTS AND PERFORMANCE.—
No data available.

FAIREY

THE FAIREY AVIATION CO., LTD.

HEAD OFFICE: HAYES, MIDDLESEX.
LONDON OFFICE: 24, BRUTON STREET, W.1.

WORKS: HAYES, MIDDLESEX; WHITE WALTHAM, NEAR MAIDENHEAD, BERKS.; STOCKPORT, CHESHIRE; RINGWAY AERODROME, NEAR MANCHESTER; AND HAMBLE, HANTS.

Directors: Sir Richard Fairey, M.B.E., F.R.Ae.S. (Chairman and Managing Director), R. T. Outen (Deputy Chairman), L. Massey Hilton, D.F.C., A.F.C., A.F.R.Ae.S. (Assistant Managing Director), M. E. A. Wright, A.F.C., F.R.Ae.S., W. Broadbent, C. H. Chichester Smith, D.S.C., A.F.R.Ae.S., R. Fairey (General Manager) and G. W. Hall, A.F.R.Ae.S.

The Fairey Aviation Co., Ltd. has specialised on naval types for many years, although not to the exclusion of aircraft suitable for other purposes.

The principal production during 1953 concerned the Firefly, which continues in service with the Royal Navy, the Royal Australian Navy and the Royal Netherlands Navy, and the Gannet three-seat anti-submarine aircraft which is entering service with the Royal Navy and has been ordered for the Royal Australian Navy.

A very small monoplane designed for research on delta wing plan-forms made its first flight in March, 1951, and mention has also been made of an even more advanced type of aircraft for which the company had obtained a Ministry of Supply contract.

The company has also received a contract for the construction of a prototype of a much larger rotary wing aircraft than the Gyrodyne, development of which began in 1946. The new machine, known as the Rotodyne, will be powered by two Napier Eland turboprop engines, which will also be arranged to supply compressed air to combustion units located



The third prototype Fairey Gannet Anti-submarine monoplane (Armstrong Siddeley Double Mamba turboprop engine).



The first production Fairey Gannet A.S. Mk. 1 (Armstrong Siddeley Double Mamba turboprop engine).

at the tips of the four-bladed rotor. The Rotodyne will have accommodation for up to 50 passengers.

The Company's Research Division continues development work with various types of guided missiles. Some details of its research work with vertical take-off aircraft were released in 1953.

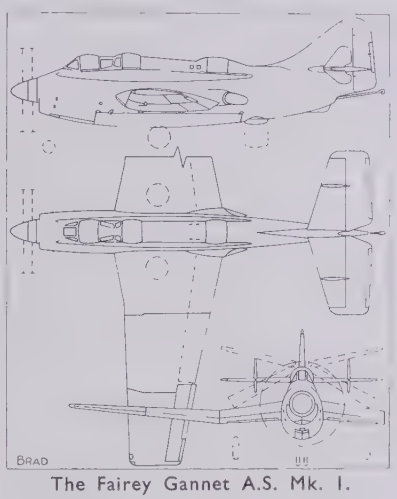
Other activities of the Fairey Company, conducted by its various subsidiary companies, include air survey and air photography, the development and manufacture of plastics, and the design and manufacture of light marine craft.

THE FAIREY GANNET.

The Gannet is a three-seat anti-submarine aircraft which is now going into service with the Royal Navy. It has also been ordered by the Royal Australian Navy. The prototype, then a two-seater and known as the Fairey 17, flew for the first time on September 29, 1949, and was the first aeroplane to fly with a double turboprop engine.

The power-plant of the Gannet is an Armstrong Siddeley Double Mamba which develops 2,950 s.h.p. plus 810 lb. (368 kg.) s.t. for take-off. The Double Mamba consists basically of two Mamba engines placed side-by-side, each driving one of two co-axial contra-rotating airscrews. For long-range cruising one or other of the engines and its airscrew can be stopped and feathered, the full power of both engines being used mainly for take-off and for combat.

The Gannet is a mid-wing monoplane with a "cranked" wing, and has a retract-



The Fairey Gannet A.S. Mk. 1.

able tricycle landing-gear and a triple-finned and single-ruddered tail-unit. The pilot is located well forward and has an outstandingly good view over the very short nose. Internal stowage is provided for the war load in the roomy fuselage, and there is a retractable radome in the rear fuselage. A tail sting-type arrester hook and catapult points are fitted.

Provision is made for the carriage of a variety of war stores, including sono-buoys, beneath the wings. Wings are folded mechanically, the inner sections folding up and outer sections folding down simultaneously.

DIMENSIONS.—
Span 54 ft. 4 in. (16.56 m.).
Width (wings folded) 19 ft. 6 in. (5.94 m.).
Length 43 ft. (13.11 m.).
Height 13 ft. 8½ in. (4.18 m.).
Height (wings folded) 13 ft. 9 in. (4.19 m.).

WEIGHTS AND PERFORMANCE.—
No data available for publication.

THE FAIREY FIREFLY.

The Firefly, which in its prototype form first flew on December 22, 1941, is still in production for the Royal Navy. The current production version is the Mk. 7, but most of the earlier operational marks are still in use in the Royal Navy, the Royal Australian Navy and the Royal Netherlands Navy. Re-conditioned Mk. 1's have been supplied to the air forces of Ethiopia and Siam. Fairey target-tugs are in service in Sweden and Denmark.

The following versions of the Firefly have been built :—

Firefly Mk. 1. 1,990 h.p. Rolls-Royce Griffon 2 or 12 engine driving Rotol three-blade airscrew. F. Mk. 1 was early day fighter ; F.R. Mk. 1 and 1A were later standard reconnaissance fighters with search radar in radome under nose of fuselage. N.F. Mk. 1 was night fighter carrying special radar. Each of these versions was armed with two 20 mm. cannon in each wing.

Firefly T. Mk. 1. Basically an F. Mk. 1 converted for use as a deck-landing



The Fairey Firefly T. Mk. 1 Two-seat Operational Trainer (Rolls-Royce Griffon 12 engine).



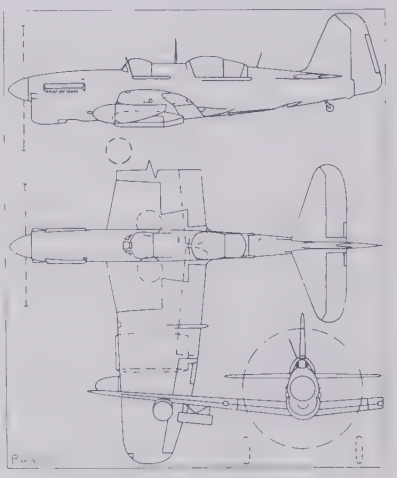
The Fairey Firefly A.S. Mk. 6 Anti-submarine Monoplane (Rolls-Royce Griffon 74 engine).

conversion and instrument flying trainer. Rear cockpit, occupied by instructor, is 12 in. (30.5 cm.) above level of forward cockpit. Dual controls fitted. Usually weaponless but a few delivered with one 20 mm. cannon in each wing, and gyro gunsight in front cockpit.

Firefly T.T. Mk. 1. Developed from Mk. 1, this version is fitted for towing glider, banner or sleeve targets for ground-to-air or air-to-air firing practice. Fitted with standard Type B. Mk. 2B windmill winch capable of streaming 7,000 ft. (2,150 m.) of cable, with windmill re-wind. When streaming a 3 ft. drogue the aircraft has a max. cruising speed of 244 m.p.h. (395 km.h.) at 17,000 ft. (5,180 m.) in F.S. gear. Normal all-up weight 11,450 lb. (5,200 kg.). A number of these target-tugs have been delivered to Sweden and Denmark.

Firefly T. Mk. 2. Armaments trainer. Similar to T. Mk. 1 with one 20 mm. cannon in each wing and gyro gunsight with separate ranging control in each cockpit. Provision for carriage of bombs and rockets, or long-range fuel tanks.

Firefly T. Mk. 3. Rolls-Royce Griffon 12 engine. A version of the F.R. Mk. 1 intended specifically to train observers. Rear cockpit equipped with the fullest possible range of radio and radar equipment. Otherwise similar to F.R. Mk. 1. It does not have the raised rear cockpit of the Firefly T. Mk. 1 and T. Mk. 2.



The Fairey Firefly Mk. 7.

Firefly F.R. Mk. 4. Rolls-Royce Griffon 74 engine driving Rotol four-blade airscrew. Radiators moved from beneath nose to leading-edge extensions of centre-section. Wings reduced in span and given square tips. Increased fin area. Auxiliary fuel tank beneath port outer wing, and faired radome under starboard outer wing. Armament same as Mk. 1 but can carry in addition bombs of various sizes up to 1,000 lb. (454 kg.) (max. $2 \times 1{,}000$ lb. = 454 kg.) sixteen 60-lb. (27 kg.) rockets or eight heavier rockets, or long-range drop tanks on bomb pick-up points.

Firefly T.T. Mk. 4. Modified Mk. 4 with target-towing equipment.

Firefly Mk. 5. Rolls-Royce Griffon 74 engine. In three forms N.F., F.R. and A.S., all similar externally to Mk. 4. F.R. Mk. 5 carries same radar in starboard wing nacelle as Mk. 4 and is equipped with beam approach, I.F.F. and communications radio. The N.F. Mk. 5 has same basic radio as F.R. plus radio altimeter and other night-flying equipment. The A.S. Mk. 5 anti-submarine version has same radar and radio but carries special submarine detection equipment under wings and fuselage.

Firefly A.S. Mk. 6. Anti-submarine



The Fairey Firefly Mk. 7 Anti-submarine Trainer (Rolls-Royce Griffon engine).

aircraft. Structurally similar to the A.S. Mk. 5, but with different operational equipment and no armament.

Firefly A.S. Mk. 7 and T. Mk. 7. Rolls-Royce Griffon engine with "chin" radiator and driving four-blade airscrew. Three-seat unarmed anti-submarine aircraft carrying radio and radar appropriate for latest detection devices, and sonobuoys for tracking a target at sea. New blister-enclosed rear cockpit accommodates two radar operators. Elliptical wings as on Mk. I without wing radiators used in Mks. 4, 5 and 6. New tail-unit. Used chiefly as an anti-submarine training aircraft.

The description which follows refers to the Mk. 5.

TYPE. — Two - seat Naval Reconnaissance Fighter or Anti-submarine aircraft.

WINGS.—Low-wing cantilever monoplane. One-piece centre-section back to rear spar fits into recess in underside of fuselage. Folding outer sections have trailing-edge portions extending inwardly to the fuselage centre-line. Wings, which are power folded, turn upward round rear spar universal hinges and swing backward to lie, trailing-edge down, along sides of fuselage. Wings are locked in flying position hydraulically. All-metal wing structure with stressed metal skin. Retractable Youngman aerofoil flaps beneath trailing-edge from ailerons to centre-line of fuselage. Flaps may be swung down and set to give varying positions for take-off, cruising and landing. Hydraulic operation. Trim-tab in port aileron. Gross wing area 330 sq. ft. (30.65 m.²).

FUSELAGE.—Oval section metal semi-monocoque structure with smooth metal skin.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with metal-covered fin, tailplane and elevators and fabric-covered rudder. Trim-tabs in all movable surfaces.

LANDING GEAR.—Retractable type. Oleo shock-absorber struts. Fully retractable tail-wheel. Hydraulic operation with emergency hydraulic hand pump. Retractable deck arrester hook under rear fuselage. Catapult points in fuselage are retractable at the front station and removable at the rear.

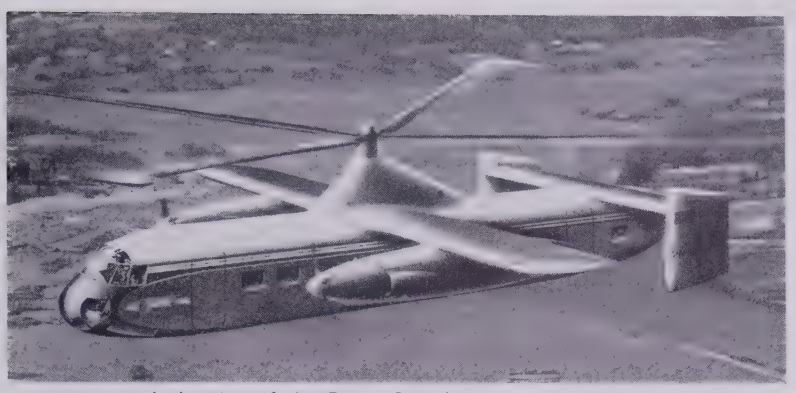
POWER PLANT.—One 2,250 h.p. Rolls-Royce Griffon 74 twelve-cylinder vee liquid-cooled engine driving a Rotol four-blade constant-speed airscrew. Radiators in leading-edge of centre-section, with thermostatically-controlled mechanically-interconnected flaps at exit ducts. Main self-sealing fuel tank in fuselage behind pilot's cockpit. Auxiliary fuel tank carried beneath port outer wing and is balanced on opposite side by radar equipment carried in a similarly-shaped housing. Oil tank in centre-section.

ACCOMMODATION.—Pilot's cockpit over leading-edge of wing. Observer/radio-operator/navigator aft of trailing-edge of wing. Sliding and jettisonable canopies over both cockpits.

ARMAMENT.—Four 20 mm. British Hispano Mk. V cannon, two in the leading-edge of each outer wing. Provision for rocket projectile gear (max. 16×60 lb.=27 kg. zero-length rockets). Bombs (max. 2×1,000 lb.=454 kg.) on external fittings under outer wings. Radar, radio, night-flying equipment, etc.

DIMENSIONS.—
Span 41 ft. 2 in. (12.55 m.).
Length 37 ft. 11 in. (11.56 m.).
Height (tail down, one airscrew blade vertical) 14 ft. 4 in. (4.37 m.).

WEIGHTS AND LOADINGS.—
Normal loaded weight 13,927 lb. (6,317 kg.).
Max. loaded weight (with two 1,000 lb.=454 kg. bombs) 16,096 lb. (7,301 kg.).
Wing loading (max.) 48.15 lb./sq. ft. (235 kg./m.²).
Power loading (max. weight) 7.9 lb./sq. ft. (3.6 kg./h.p.).



A drawing of the Fairey Rotodyne in its latest form.

PERFORMANCE.—
Max. speed 386 m.p.h. (618 km.h.) at 14,000 ft. (4,270 m.).
Climb to 10,000 ft. (3,050 m.) 6 min. 50 sec.
Climb to 20,000 ft. (6,095 m.) 15 min. 30 sec.
Max. range with standard internal tankage at 210 m.p.h. (336 km.h.) 760 miles (1,225 km.).
Max. range with long-range tankage 1,300 miles (2,090 km.).

THE FAIREY ROTODYNE.

The Rotodyne, for which a contract for the construction of a prototype has been placed, will be a commercial vehicle capable of carrying a useful load of 13,000 lb. (5,897 kg.) at speeds much higher than those of conventional helicopters. The general arrangement of the Rotodyne can be seen in the accompanying illustration.

The Rotodyne will be powered by two Napier Eland turboprop engines, which will also supply compressed air to the rotor tip combustion units. In vertical flight full power in the form of compressed air will be delivered to the rotor-jets, while in horizontal flight the greater percentage of power will be transmitted to the turbo propellers.

The Rotodyne has been designed with a view to meeting the requirements of British European Airways for a large inter-city "rotor-coach" to carry up to 50 passengers. A variety of arrangements of the cabin will permit great flexibility of employment. The fuselage is unrestricted throughout its length and rear loading-doors for loading vehicles or heavy freight can be provided.

THE FAIREY V.T.O. PROJECT.

Details were released in 1953 of one of the series of V.T.O. (vertical take-off) delta-wing rocket - powered aircraft models which has been successfully tested on the Woomera Rocket Range, Australia. These tests have explored the practicability of launching aircraft from short ramps at low accelerations and have included test launches in near-vertical climbs. The Fairey company has been engaged in the development of this project for several years under a Ministry of supply contract, the first V.T.O. model having been successfully fired in Cardigan Bay, Wales, on May 1, 1949.

The V.T.O. model illustrated is powered by a Fairey-developed Beta I rocket motor which has two jets (900 lb. = 410 kg. thrust each), one of which can be swivelled laterally and the other vertically according to signals from an autopilot. The resulting mean thrust line can thus be varied to maintain controlled flight at low speeds. Two 600 lb. (275 kg.) solid fuel booster rockets are also used during the initial stages of launching.



The Fairey V.T.O. Delta-wing Rocket-powered aircraft.

FOLLAND

FOLLAND AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: HAMBLE, HANTS.

Chairman: C. L. Hill.

Directors: W. E. W. Petter, C.B.E., B.A., F.R.Ae.S. (Managing), H. P. Folland, O.B.E., F.R.Ae.S., F.R.S.A., F.I.Ae., E. N. Egan, A.C.W.A. (Secretary), T. Gilbertson (General Manager), E. C. Lysaght, R. J. Norton.

Chief Designer: F. H. Pollicutte, F.R.Ae.S.

Aeronautical Consultant: Prof. E. J. Richards, M.A., B.Sc., F.R.Ae.S.

This Company, originally formed as British Marine Aircraft Ltd., in February, 1936, has extensive works at Hamble on Southampton Water.

During the war years, in addition to large scale sub-contract work, the Company designed and produced the Folland 43/37 flying engine test bed, and was also responsible for two other original types of its own design, the E.28/40 Torpedo Bomber and the F.19/43 Fighter, although neither of the two latter aircraft was actually completed owing to changes in Government policy.

During 1952 the Company undertook a substantial amount of sub-contract work, which included large-scale production of wings for the de Havilland Venom. The prototype folding wings for the Sea Venom were also built at Hamble, and production of tailplanes for the Hawker Hunter was begun.

Folland is undertaking, as a private venture, the design and production of two prototypes of a light high performance jet fighter to be known as the Gnat.

GLOSTER



The Gloster Javelin Two-seat All-weather Fighter (two Armstrong Siddeley Sapphire turbojet engines).

GLOSTER AIRCRAFT CO. LTD.

HEAD OFFICE, WORKS AND AERODROME: HUCCLECOTE, GLOS.

Directors: Sir Thomas Sopwith, K.B., C.B.E., F.R.Ae.S., H. Burroughes, F.R.Ae.S., P. G. Crabbe, F.R.Ae.S., M.I.P.E. (Managing Director), R. V. Atkinson (Works Manager), W. G. Carter, C.B.E., F.R.Ae.S. (Technical) and E. W. Shambrook, F.C.I.S. (Secretary).

Chief Pilot: W. A. Waterton, G.M., A.F.C.

The Gloster Aircraft Co., Ltd., which now forms part of the Hawker Siddeley Group, was formed in 1915 and since then has specialised mainly in the production of high-performance military aircraft.

To the Gloster company belongs the distinction of being the first aircraft manufacturer in either Great Britain or the United States to design, build and fly an aircraft propelled by a gas-turbine jet engine. From the experience gained in the design, construction and flight testing of the two E.28/39 prototypes, the first of which flew on May 15, 1941, the Gloster company designed and put into production the Meteor single-seat twin-jet fighter.

The Meteor, in various marks, has been in service in the R.A.F. since 1943. It has also been supplied to many foreign air forces, including those of the Argentine Republic, Australia, Belgium, Brazil, Denmark, Egypt, France, Holland and Syria. The Meteor has also been produced under licence in Holland by the Fokker Company for supply to certain Western Union countries.

Over and above its normal production commitments, the Company is engaged in a very extensive development and research programme on entirely new projects, of which the Javelin twin-engined all-weather delta-wing fighter, briefly described below, is an example.

THE GLOSTER G.A.5 JAVELIN.

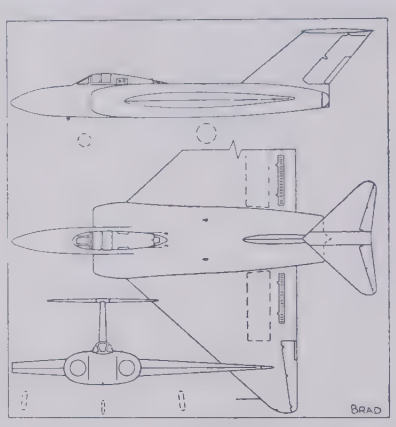
The Javelin is the first twin-engined delta-wing aircraft and the first in Britain to be designed for a specific operational rôle—that of an All-weather Fighter. Three prototypes of the Javelin have been built, the first flying for the first time on November 26th, 1951.

In June, 1952, it was announced that Javelin had been ordered into super-priority production for the Royal Air Force under the designation Javelin F.(A.W.) Mk. 1.

The only details of the Javelin which were available at the time of going to press follow.

TYPE.—Two-seat All-weather Fighter.

WINGS.—Mid-wing monoplane of Delta configuration. 39° leading-edge sweepback.



The Gloster Javelin.

All-metal stressed-skin structure. Power-boosted all-metal ailerons. Hydraulically-operated all-metal flaps.

FUSELAGE.—All-metal stressed-skin structure.

TAIL UNIT.—All surfaces swept-back. Variable-incidence delta tailplane at top of fin. All-metal stressed-skin structure. Tailplane span 17 ft. (5.18 m.).

LANDING GEAR.—Retractable nose-wheel type. Dowty liquid-spring shock-absorbers Dunlop wheels. Hydraulic retraction.

POWER PLANT.—Two Armstrong Siddeley Sapphire turbojet engines (7,200 lb.= 3,270 kg. s.t. each) in nacelles on sides of fuselage.

ACCOMMODATION.—Crew of two in tandem in pressurised cockpit. Martin-Baker ejection seats.

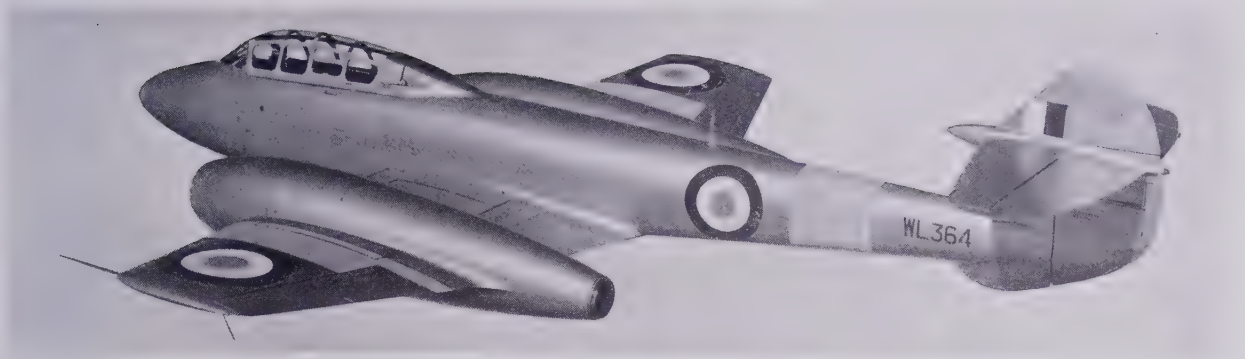
DIMENSIONS.—
Span 52 ft. (15.86 m.).
Length 57 ft. (17.38 m.).
Height 17 ft. (5.18 m.).

THE GLOSTER G.41 METEOR.

The Meteor was designed to meet Specification F.9/40, the first such British specification to be issued for a combat aircraft using jet propulsion. The eight original F.9/40 airframes were used to test several different types of British gas-turbines including the Rover-built Power Jets W2B, the parent design of the Rolls-Royce Welland with which the Meteor 1 was fitted; the Metropolitan Vickers F.2/1, the first British axial flow unit to fly (November 13, 1943); the Halford H.1, the predecessor to the D.H. Goblin; and the Rolls-Royce Trent, the first airscrew gas-turbine to fly. Actually the Halford-engined F.9/40 was the first



The Gloster Javelin Two-seat All-weather Fighter.



The Gloster Meteor T. Mk. 7 Trainer (two Rolls-Royce Derwent turbojet engines).

version of the Meteor to fly (March 5, 1943) as the W2B engines installed in another F.9/40 in July, 1942, were not ready for flying until June, 1943.

The Meteor was the only Allied jet-propelled aeroplane to go into operational service in the War 1939-45.

The Meteor 4 set up World's Speed Records in 1945 at 606 m.p.h. (969.6 km.h.) and in 1946 at 616 m.p.h. (991 km.h.). In 1950 the Meteor 8 established international point-to-point records between London-Copenhagen, Copenhagen-London and London-Copenhagen-London at speeds of 541.4 m.p.h. (866.3 km.h.), 500.7 m.p.h. (801.1 km.h.) and 479.5 m.p.h. (767.2 km.h.) respectively. In 1951 a Meteor 8 set up a new international speed record over a 1,000 km. (621 mile) closed circuit at 510.9 m.p.h. (822.2 km.h.). Full details of these records have been given in previous editions of "All the World's Aircraft."

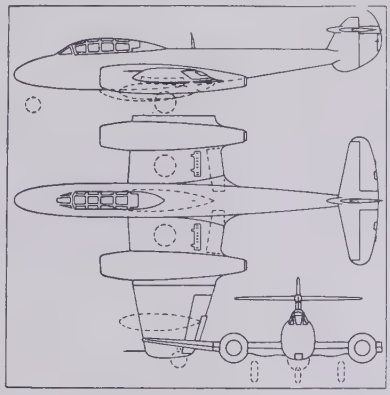
The following are the principal versions of the Meteor :—

Meteor F. Mk. 1. Two Rolls-Royce Welland 1 turbojets (1,700 lb. = 770 kg. s.t. each). Canopy type side-hingeing cockpit hood. Only twenty built.

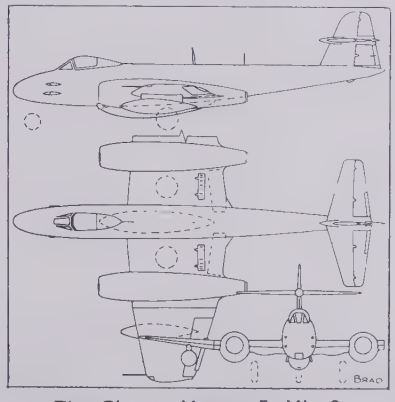
Meteor F. Mk. 3. Two Rolls-Royce Derwent 1 turbojets (2,000 lb. = 910 kg. s.t. each), although the first fifteen Mk. 3's were fitted with the Welland. The first quantity production version. Sliding cockpit hood. Last fifteen Mk. 3's fitted with the lengthened engine nacelles standardised on the Mk. 4. Provision for long-range fuselage drop tank.

Meteor F. Mk. 4. Two Rolls-Royce Derwent 5 turbojets. Produced in quantity for R.A.F. Wings of reduced span (37 ft. 2 in.=11.3 m.) to improve rate of roll. Long engine nacelles, pressure cabin, and fittings for bombs and rocket projectiles. The first Mk. 4 flew on April 12, 1945.

Meteor T. Mk. 7. Two-seat Trainer version of the Mk. 4. Forward fuselage lengthened 30 in. (0.76 m.) to accommodate tandem cockpits under continuous canopy which hinges to starboard to give access to both seats. Complete dual controls. No armament or military load. First T. Mk. 7 flew on March 19, 1948.



The Gloster Meteor T. Mk. 7 Trainer.



The Gloster Meteor F. Mk. 8.

Meteor F. Mk. 8. Progressive development of Mk. 4. Lengthened fuselage containing additional fuel tank behind pilot, increasing total internal fuel capacity to 420 Imp. gallons (1,910 litres). Re-designed tail unit to improve flight characteristics at high Mach. numbers and to raise limiting Mach. number to 0.82 (true). Re-designed cockpit with retractable gyro gun-sight and Martin Baker ejector seat. Provision under-wing for two 1,000 lb. (454 kg.) bombs or sixteen rocket projectiles in two tiers. First Mk. 8 flew on October 12, 1948.

Meteor F.R. Mk. 9. Fighter-reconnaissance version of the Mk. 8. Provision in nose for carrying the necessary camera and equipment, and nose fairing modified to include a front downward-facing and side oblique photographic windows. The standard armament of four cannon in the nose is retained. Length 43 ft. 6 in. (13.25 m.). First Mk. 9 flew on March 23, 1950.

Meteor P.R. Mk. 10. Unarmed version for high altitude reconnaissance. To improve the handling qualities at height, long-span wings of the early Mk. 3 type are fitted, and the Mk. 4 tailplane is used. In other respects this mark retains the features of the Mk. 8. The camera-carrying nose is similar to that of the Mk. 9, and in addition provision is made for a vertical camera in the rear fuselage. Span 43 ft. 0 in. (13.1 m.). Length 44 ft. 3 in. (13.5 m.). First Mk. 10 flew on March 29, 1950.

Meteor N.F. Mk. 11. Two-seat Night Fighter, the design of which was undertaken by Sir W. G. Armstrong Whitworth Aircraft Ltd., which company is also responsible for its production. First flew in May, 1950. For further details see under "Armstrong Whitworth."

The description below refers mainly to the Meteor F. Mk. 8, but weights and



The Gloster Meteor F. Mk. 8 Single-seat Fighter (two Rolls-Royce Derwent turbojet engines).

performances are given for the Mks. 7, 8, 9 and 10.

TYPE.—Single-seat twin-jet fighter.

WINGS.—Low-wing cantilever monoplane. Wing section E.C. 1240 from root to outer centre-section wing joint, E.C. 1240 tapering to E.C. 1040 from joint to tip. Aspect ratio 3.9. All-metal two-spar stressed-skin structure. All-metal ailerons, internally mass-balanced, fitted with long-chord mechanically-operated servo balance-tabs. Hydraulically-operated split flaps and upper and lower air brakes, latter on centre-section inboard of engine nacelles. Wing area 350 sq. ft. (32.5 m.²).

FUSELAGE.—All-metal stressed-skin structure.

TAIL UNIT.—Cantilever all-metal two-spar stressed-skin tailplane. All-metal fin integral with rear fuselage. All-metal aerodynamic and mass-balanced rudder and elevators. Adjustable trim-tab in rudder. Adjustable trim-tabs in elevators. Tailplane span 15 ft. 8 in. (4.77 m.).

LANDING GEAR.—Retractable tricycle type. Castoring and self-centering nose-wheel. Dowty levered-action oleo-pneumatic shock absorbers to all three wheels. Main legs compressed on retraction to lessen space occupied in wings. Hydraulic retraction, with emergency hand-pump. Dunlop pneumatically-operated brakes on main wheels. Wheel track 10 ft. 5 in. (3.18 m.), wheel base 13 ft. 4 in. (4.00 m.).

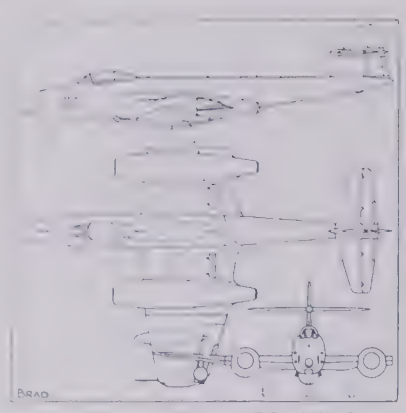
POWER PLANT.—Two Rolls-Royce Derwent 8 turbo-jet engines (3,500 lb.=1,585 kg. s.t.) in nacelles at extremities of centre-section. Main fuel tanks in fuselage. Capacity 420 Imp. gallons (1,910 litres). Provision for one external drop tank (180 Imp. gallons=818 litres) under fuselage and two external wing tanks (100 Imp. gallons=455 litres each). Graviner manual-impact and/or inertia fire-extinguisher system.

ACCOMMODATION.—Fully pressurised pilot's cockpit with heating, ventilating, anti-icing and de-misting systems. Electrically-operated sliding jettisonable cockpit hood. Martin-Baker ejector seat. Pilot armour and bullet-resisting windscreen. Oxygen system incorporating automatic flow control and economiser. Ultra-violet and normal instrument lighting.

ARMAMENT.—Four 20 mm. British Hispano Mk. 5 cannon in nose, two on each side of cockpit (195 r.p.g.). Cannon heating and pneumatic ground cocking systems. Camera-gun in fuselage nose fairing. Attachment points under wings for two 1,000-lb. (454-kg.) bombs or sixteen 90-lb. (40.8-kg.) rocket projectiles.

DIMENSIONS (F. Mk. 8).—
Span 37 ft. 2 in. (11.3 m.).
Length 43 ft. 6 in. (13.2 m.).
Height (over tail) 13 ft. 10 in. (3.96 m.).
Engine centres 15 ft. 4 in. (4.67 m.).

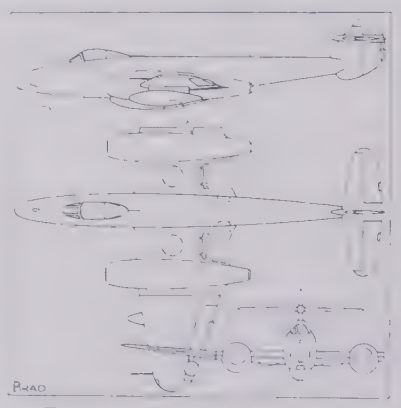
WEIGHTS.—(T. Mk. 7.).
Weight empty 10,540 lb. (4,780 kg.).
Removable equipment 164 lb. (74.4 kg.).
Pilot, pupil, parachutes, dinghies, etc. 448 lb. (204 kg.).
Fuel and oil 2,683 lb. (1,217 kg.).
Ballast 300 lb. (136 kg.).
Weight loaded 14,140 lb. (6,410 kg.).



The Gloster Meteor F.R. Mk. 9.

WEIGHTS (F. Mk. 8).—
Weight empty 10,626 lb. (4,820 kg.).
Removable equipment 173 lb. (78 kg.).
Pilot, parachute, dinghy, etc. 225 lb. (102 kg.).
Armament, ammunition, etc. 1,026 lb. (465 kg.).
Ballast 175 lb. (79 kg.).
Fuel (420 Imp. gallons=1,910 litres) 3,400 lb. (1,542 kg.).
Weight loaded (internal fuel only) 15,675 lb. (7,109 kg.).
Weight loaded (with ventral drop tank) 17,250 lb. (7,824 kg.).
Weight loaded (with ventral and underwing tanks) 19,000 lb. (8,636 kg.).

WEIGHTS (F.R. Mk. 9).—
Weight empty 10,790 lb. (4,893 kg.).
Weight loaded (internal fuel) 15,770 lb. (7,152 kg.).
Weight loaded (ventral tank) 17,350 lb. (7,867 kg.).
Weight loaded (ventral and wing drop tanks) 19,135 lb. (8,679 kg.).



The Gloster Meteor P.R. Mk. 10.

WEIGHTS (P.R. Mk. 10).—
Weight empty 10,993 lb. (4,988 kg.).
Weight loaded (internal fuel) 15,400 lb. (6,987 kg.).
Weight loaded (ventral tank) 16,975 lb. (7,702 kg.).
Weight loaded (ventral and wing drop tanks) 18,765 lb. (8,515 kg.).

PERFORMANCE (T. Mk. 7) at 14,140 lb. (6,410 kg.) loaded weight).—
Speeds from sea level to 40,000 ft. (12,190 m.) same as F. Mk. 4.
Rate of climb at sea level 8,000 ft./min. (2,440 m./min.).
At 10,000 ft. (3,050 m.); 6,700 ft./min. (2,040 m./min.).
At 25,000 ft. (7,625 m.); 5,200 ft./min. (1,585 m./min.).
At 30,000 ft. (9,150 m.); 3,650 ft./min. (1,110 m./min.).
At 40,000 ft. (12,190 m.); 2,050 ft./min. (625 m./min.).
Range at 30,000 ft. (9,150 m.) with normal internal fuel (325 Imp. gallons = 1,480 litres) 470 miles (752 km.).
Total distance to clear 50 ft. (15.25 m.) in take-off 785 yds. (720 m.).
Total landing distance from 50 ft. (15.25 m.) 935 yds. (850 m.).

PERFORMANCE (F. Mk. 8 at 15,675 lb.=7,109 kg. A.U.W.).—
*Max. speed at S.L. 592 m.p.h. (956 km.h.).
Max. speed at 20,000 ft. (6,100 m.) 575 m.p.h. (927 km.h.).
Max. speed at 40,000 ft. (12,200 m.) 534 m.p.h. (860 km.h.).
Max. continuous cruise at 20,000 ft. 414 m.p.h. (667 km.h.).
Max. continuous cruise at 40,000 ft. 270 m.p.h. (435 km.h.).
Rate of climb at S.L. 7,000 ft./min. (35.5 m./sec.).
Rate of climb at 20,000 ft. 4,200 ft./min. (21.3 m./sec.).
Rate of climb at 40,000 ft. 1,200 ft./min. (6.1 m./sec.).
Service ceiling 44,000 ft. (13,410 m.).
Range (still air) at 20,000 ft. 520 miles (840 km.).
Range (still air) at 40,000 ft. 710 miles (1,143 km.).
Take-off run 1,450 ft. (440 m.).
Landing run 1,500 ft. (455 m.).

PERFORMANCE (F. Mk. 8 at 17,250 lb.=7,824 kg. A.U.W.).—
*Max. speed at S.L. 552 m.p.h. (883 km.h.).
Max. speed at 20,000 ft. (6,100 m.) 425 m.p.h. (686 km.h.).
Max. speed at 40,000 ft. (12,200 m.) 270 m.p.h. (435 km.h.).
Max. continuous cruise at 20,000 ft. 397 m.p.h. (639 km.h.).
Max. continuous cruise at 40,000 ft. 247 m.p.h. (398 km.h.).
Rate of climb at S.L. 5,800 ft./min. (29.46 m./sec.).
Rate of climb at 20,000 ft. 3,350 ft./min. (16.8 m./sec.).
Rate of climb at 40,000 ft. 600 ft./min. (3.05 m./sec.).
Service ceiling 40,000 ft. (12,200 m.).
Range (still air) at 20,000 ft. 725 miles (1,170 km.).
Range (still air) at 40,000 ft. 980 miles (1,575 km.).



The Gloster Meteor P.R. Mk. 10 Unarmed Photographic Reconnaissance Monoplane (two Rolls-Royce Derwent turbojet engines).

Take-off run 2,100 ft. (640 m.).
*Max. permissible Mach. No.—0.82 (*true*).
PERFORMANCE (F.R. Mk. 9 at 15,770 lb.= 7,152 kg. A.U.W.).—
Same as for Mk. 8 at 15,675 lb.=7,109 kg.
PERFORMANCE (P.R. Mk. 10 at 15,400 lb.= 6,987 kg. A.U.W.).—
Max. speed at S./L. 500 m.p.h. (806 km.h.).
Speed at 10,000 ft. (3,050 m.) 574 m.p.h. (927 km.h.).
Speed at 20,000 ft. (6,100 m.) 551 m.p.h. (890 km.h.).
Speed at 30,000 ft. (9,150 m.) 540 m.p.h. (871 km.h.).
Speed at 40,000 ft. (12,190 m.) 529 m.p.h. (852 km.h.).
CLIMBS AND RANGES (P.R. Mk. 10 at 17,345 lb.=7,867 kg. A.U.W.).
Rate of climb at S/L. 6,050 ft./min. (30.7 m./sec.).
Rate of climb at 20,000 ft. (6,100 m.) 3,700 ft./min. (18.8 m./sec.).
Rate of climb at 40,000 ft. (12,190 m.) 1,100 ft./min. (5.6 m./sec.).
Climb to 10,000 ft. (3,050 m.) 1.9 min.
Climb to 20,000 ft. (6,100 m.) 4.1 min.
Climb to 40,000 ft. (12,190 m.) 13.3 min.
Ceiling (500 ft./min.) 47,000 ft. (14,330 m.).
Range at S/L. 477 miles (769 km.).
Range at 20,000 ft. (6,100 m.) 752 miles (1,214 km.).
Range at 40,000 ft. (12,190 m.) 1,090 miles (1,760 km.).
RANGES (P.R. Mk. 10 at 18,765 lb.=8,514 kg. A.U.W.).-
Range at S/L. 615 miles (990 km.).
Range at 20,000 ft. (6,100 m.) 955 miles (1,538 km.).
Range at 40,000 ft. (12,190 m.) 1,140 miles (1,844 km.).

HANDLEY PAGE



The Handley Page Victor High-performance Bomber (four Armstrong Siddeley Sapphire turbojet engines).

HANDLEY PAGE, LTD.
HEAD OFFICE AND WORKS: CRICKLEWOOD, LONDON, N.W.2.
AERODROME: COLNEY STREET, RADLETT, HERTFORDSHIRE.

Directors: Sir Frederick Handley Page, C.B.E. (Chairman and Managing Director), Air Cdre, A. Vere Harvey, C.B.E., M.P. (Deputy Chairman), G. C. D. Russell, A.F.R.Ae.S. (Assistant Managing Director), A. A. Lough, F.C.A., F. S. Gaylor.
Technical Director: R. S. Stafford, F.R.Ae.S.
Chief Designer: C. F. Joy, A.F.R.Ae.S.
Secretary and Chief Accountant: J. H. S. Green, A.C.A.

Handley Page, Ltd., has been associated with flying in all its aspects since June 17, 1909. It thus possesses the proud distinction of being the first limited company incorporated in Great Britain for the purpose of manufacturing aircraft.

The latest product of the company is the "crescent-wing" Victor bomber, which is in super-priority production for the Royal Air Force.

In addition to Victor production, Handley Page is, at the request of the Ministry of Supply, building a number of English Electric Canberra bombers for the Royal Air Force.

THE HANDLEY PAGE H.P. 97.

This designation has been given to a project for a four-jet intercontinental airliner which will make use of the "crescent" wing design of the H.P.80. A large double-deck fuselage will have accommodation for a maximum of 96 first class or 150 tourist-class passengers, with a total loading-carrying capacity of 50,000 lb. (22,700 kg.).

THE HANDLEY PAGE H.P.80 VICTOR.

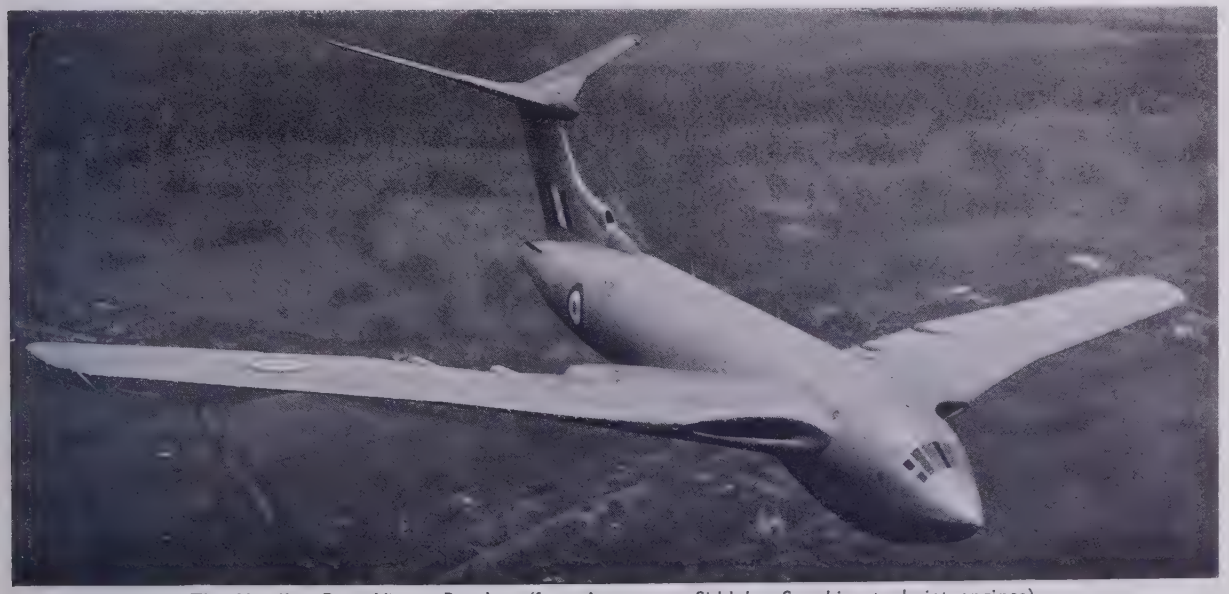
The Victor four-jet bomber employs the so-called "crescent wing" in which the angle of sweep of each wing is progressively decreased from root to tip, with the outer sections only slightly swept.

This configuration was evolved to meet the demands of a specification which called not only for operation at high sub-sonic speeds at altitude over very long ranges, but also good control over the whole speed range, particularly at the approach and landing.

At the time of writing security restrictions did not permit the publication of any details of the Victor beyond the fact that it is powered by four Armstrong Siddeley Sapphire turbojet engines.

THE HANDLEY PAGE H.P.67 HASTINGS.

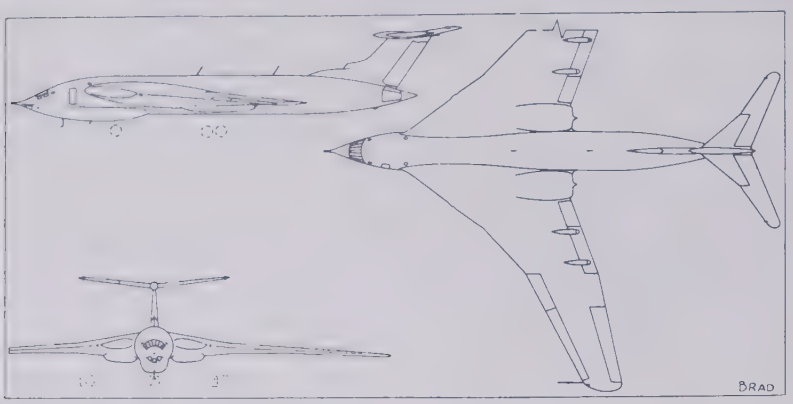
The Hastings is a general purpose long-range transport which is in service in the Royal Air Force and the Royal New Zealand Air Force. Its *rôles* include those of (*a*) freighter, accommodating bull-dozers, 25-pdr. anti-tank guns and 3-ton tanks; (*b*) paratroop transport, carrying 30 paratroops and 20 supply containers; (*c*) ambulance, accommodating 32 stretcher and 28 sitting cases, four attendants and one ton of medical supplies; (*d*) troop-carrier, with provision for 50 fully equipped airborne troops; (*e*) supply dropper, when a typical load would be twenty-four 350 lb. (160 kg.) panniers and twenty 400 lb. (182 kg.) containers;



The Handley Page Victor Bomber (four Armstrong Siddeley Sapphire turbojet engines).



Another view of the Handley Page Victor Bomber (four Armstrong Siddeley Sapphire engines).



The Handley Page H.P. 80 Victor Bomber.

(*f*) jeep carrier, with a jeep or anti-tank gun on a carrier fitted beneath the fuselage ; and (*g*) glider tug.

The following are the production versions of the Hastings :—

Hastings C. Mk. 1. Four Bristol Hercules 101 engines. Initial production version. Tailplane mounted above centre line of fuselage. Total internal fuel capacity 2,560 Imp. gallons (11,650 litres). Max. take-off weight 80,000 lb. (36,200 kg.).

Hastings Met. Mk. 1. Specially equipped version of the C. Mk. 1 for long-range meteorological reconnaissance.

Hastings C. Mk. 2. Four Bristol Hercules 106 engines. Tailplane lowered to centre-line of fuselage and increased in area to 442 sq. ft. (41.1 m.²) ; spring-tabs fitted in elevators. Extra fuel tanks in outer wings increase total tankage to 3,172 Imp. gallons (14,420 litres). Crew rest station replaced by air quartermaster post. Max. payload increased to 20,311 lb. (9,221 kg.).

Hastings C. Mk. 3. Four Bristol Hercules 737 engines, with single-stage blowers. Basically similar to the C. Mk. 2 apart from engine change. Four supplied to the Royal New Zealand Air Force.

Hastings C. Mk. 4. V.I.P. version of C. Mk. 2. De luxe accommodation for four V.I.P.'s and staff. All seats face aft. Four delivered to R.A.F. Transport Command.

The description and specification which follow refer to the C. Mk. 2 ; the other Marks are structurally similar.

TYPE.—Four-engined Military Transport.

WINGS.—Cantilever low-wing monoplane. Aerofoil section NACA 23021 at root tapering to NACA 23007 at tip. Aspect ratio 9.08. Root chord 16 ft. (4.88 m.), tip chord 5 ft. 10 in. (1.78 m.). Incidence 2°. All-metal two spar structure. T.K.S. de-icing on leading-edges. Mass-balanced Frise-type ailerons on outer wings. Spring-tab in each aileron, and trim-tab in starboard. All-metal hydraulically-operated trailing-edge flaps in two sections each side between ailerons and fuselage. Total aileron area 196 sq. ft. (18.26 m.²). Total flap area 217 sq. ft. (10.08 m.²). Gross wing area 1,408 sq. ft. (130.8 m.²).

FUSELAGE.—All-metal structure of circular cross-section. Max. external diameter 11 ft. (3.35 m.).

TAIL UNIT.—All-metal cantilever monoplane type. T.K.S. de-icing to tailplane and fin. Spring-tab and trim-tab in each movable surface. Gross tailplane and elevator area 442 sq. ft. (41.1 m.²) ; total elevator area 143 sq. ft. (13.3 m.²). Rudder area 64.5 sq. ft. (6 m.²).

LANDING GEAR.—Retractable tail-wheel type. Messier main landing-gear units each with two oleo-pneumatic shock-absorber struts. Hydraulic retraction. Track 24 ft. 8 in. (7.52 m.).

POWER PLANT.—Four 1,675 h.p. Bristol Hercules 106 fourteen-cylinder two-row radial sleeve-valve air-cooled engines. Rotol cooling fan in front of engine. D.H. four-blade constant-speed full-feathering metal airscrew, 13 ft. (3.96 m.) diameter. Riveted sheet alloy and bag type fuel tanks in wings, with total capacity of 3,172 Imp. gallons (14,420 litres). Four oil tanks, each of 35 Imp. gallons (159 litres) capacity, two in centre-section and two in leading-edge between engines.

ACCOMMODATION. — Flight compartment accommodates pilot (on port) and co-pilot side-by-side with dual controls ; radio-operator, navigator and flight engineer. Crew entry hatch under nose. Entire fuselage space from crew compartment to rear bulkhead is available for freight. Max. internal diameter 10 ft. 4 in. (3.15 m.) ; max. height 7 ft. 3 in. (2.21 m.). Freight-loading door 9 ft. 5 in. wide × 5 ft. 9 in. high (2.84 m. × 1.75 m.) at rear on port side. This incorporates a paratroop door and another is fitted on starboard side. Reinforced floor with built-in channels fore-and-aft and lashing points and fittings. Walls soundproofed and lined with plywood up to 2 ft. (0.61 m.) from floor. Lightweight air-transportable ramp for loading wheeled vehicles and freight. Hand or power-operated Gyral winch at forward end of hold. Provision can be made for 30 paratroops, with supplies ; 32 stretchers plus 28 sitting wounded ; 50 fully-equipped



The Handley Page Hastings Met. Mk. 1 Long-range Meteorological Reconnaissance Monoplane.



The Handley Page Hastings C. Mk. 2 Transport (four 1,675 h.p. Bristol Hercules 106 engines).

troops ; or various combinations of military freight. Two lavatories with wash-basins and running water at rear of main cabin. Entire accommodation heated and air-conditioned. Full oxygen equipment for crew together with 35 oxygen points in main cabin. Three emergency exits in flight compartment and six in main cabin three on each side.

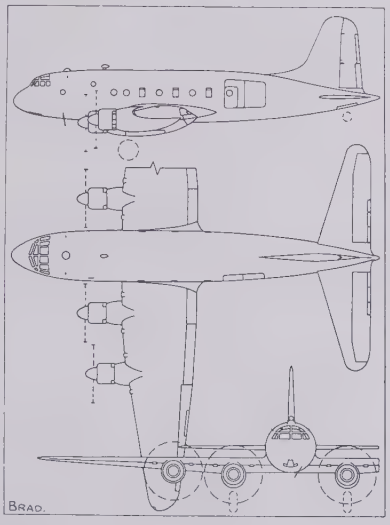
DIMENSIONS.—
Span 113 ft. (34.46 m.).
Length 81 ft. 8 in. (24.9 m.).
Height 22 ft. 6 in. (6.86 m.).

WEIGHTS.—
Basic equipped weight (freighter) 48,427 lb. (21,986 kg.).
Max. payload 20,311 lb. (9,221 kg.).
Payload 10,000 lb. (4,585 kg.) for 3,000 mile (4,827 km.) range.
Max. take-off weight 80,000 lb. (36,320 kg.).
Max. landing weight 74,000 lb. (33,570 kg.).

PERFORMANCE.—
Max. speed 348 m.p.h. (560 km.h.) at 22,200 ft. (6,770 m.).
Max. weak mixture cruising speeds 291 m.p.h. (468 km.h.) at 15,200 ft. (4,630 m.) and 302 m.p.h. (486 km.h.) at 23,600 ft. (7,190 m.).
Initial rate of climb 890 ft./min. (272 m./min.).
Climb to 20,000 ft. (6,100 m.) 26 minutes.
Service ceiling 26,500 ft. (8,077 m.).
Range for max. payload 1,690 miles (2,720 km.).
Max. range 4,250 miles (6,850 km.).
Take-off distance to 50 ft. (15.2 m.) 1,586 yds. (1,450 m.).
Landing distance from 50 ft. (15.2 m.) 1,430 yds. (1,308 m.).

THE HANDLEY PAGE H.P.81 HERMES 4.

The Hermes 4 was the first British post-war airliner to modern standards to go into service, 25 having been built



The Handley Page Hastings C. Mk. 2.

for use by B.O.A.C. on its Commonwealth routes.

A number of Hermes 4's with high-density accommodation are being operated by Airwork, Ltd. on their trooping services between England and the Middle East.

Structurally the Hermes 4 resembles the Hastings, already described, except in the following respects.

TYPE.—Four-engined Airliner.

WINGS.—General structure as for Hastings. Pulsating rubber de-icer boots on leading-edges. Hydraulically-operated double slotted flaps. Main flap 15% of wing chord, incorporates smaller insert flap, 9% of wing chord. Insert flap moves rearwards and downwards when main flap is lowered.

FUSELAGE.—General structure as for Hastings.

TAIL UNIT.—Structure as for Hastings. Gross tailplane and elevator area 401 sq. ft. (37.1 m.^{2}). Gross fin and rudder area 239 sq. ft. (22.2 m.^{2}). De-icer boots fin and tailplane.

LANDING GEAR.—Retractable tricycle type. Each main unit has an Electro-Hydraulic oleo-pneumatic shock-absorber strut and twin Dunlop wheels. Dunlop double-bag pneumatic brakes. Electro-hydraulic nose-wheel unit has twin wheels. Hydraulic retraction.

POWER PLANT.—Four 2,100 h.p. Bristol Hercules 763 fourteen-cylinder two-row sleeve-valve radial air-cooled engines. D.H. four-blade constant-speed fully-feathering and braking airscrews, 13 ft. (3.96 m.) diameter. Twelve flexible fuel tanks with a total capacity of 3,206 Imp. gallons (14,600 litres) in the intermediate and outer wings. Under-wing pressure refueling from the inner engine nacelles. Four oil tanks, each of 37 Imp. gallons (168 litres) capacity, two in the centre-section and two in the leading-edge between the engines.

ACCOMMODATION.—Flight compartment seats pilot (on port) and co-pilot side-by-side with dual controls, radio-operator ; navigator and flight engineer. Crew-entry door aft of the flight compartment on the port side. Normal accommodation is for 40 passengers, but alternative seating arrangements provide for a maximum of 74. Cabin length 44 ft. 5 in. (13.5 m.) ; width 10 ft. 3 in. (3.23 m.). Galley at forward end of



The Handley Page Hastings C. Mk. 4 V.I.P. Transport (four 1,675 h.p. Bristol Hercules 106 engines).



The Handley Page Hermes 4 Airliner (four 2,100 h.p. Bristol Hercules 763 engines).

cabin; two lavatories and dressing rooms aft. Main passenger door at aft end of cabin on port side. Baggage holds, externally accessible from the underside of the fuselage, and a bullion hold in the flight compartment give a total volume of 452 cub. ft. (42 m.³) available for freight.

DIMENSIONS.—
Span 113 ft. 0 in. (34.4 m.).
Length 96 ft. 10 in. (29.53 m.).
Height 30 ft. 0 in. (9.15 m.).

WEIGHTS AND LOADINGS.
Basic equipped weight (40-passenger version) 55,350 lb. (25,110 kg.).
Max. take-off weight 86,000 lb. (39,100 kg.).
Max. landing weight 75,000 lb. (34,018 kg.).
Wing loading 61.1 lb./sq. ft. (299 kg./m.²).
Power loading 10.24 lb./h.p. (4.64 kg./h.p.).

PERFORMANCE.—
Max. speed 355 m.p.h. (568 km.h.) at 20,000 ft. (6,100 m.).
Max. weak mixture cruising speeds 261 m.p.h. (419 km.h.) at 10,000 ft. (3,050 m.) and 266 m.p.h. (426 km.h.) at 20,000 ft. (6,100 m.).
Max. range speed 213 m.p.h. (440 km.h.) at 10,000 ft. and 242 m.p.h. (389 km.h.) at 20,000 ft. (6,100 m.).
Initial rate of climb 975 ft./min. (4.95 m./sec.).
Initial rate of climb (three engines) 440 ft./min. (2.23 m./sec.).
Climb to 10,000 ft. (3,050 m.) 10½ min.
Climb to 20,000 ft. (6,100 m.) 25 min.
Range with 6,090 lb. (2,765 kg.) payload at 20,000 ft. (6,100 m.) 3,080 miles (4,970 km.) to 3,330 miles (5,360 km.) according to speed.
Take-off run at max. weight 1,148 yds. (1,055 m.).
Take-off distance to 50 ft. (15.2 m.) 1,362 yds. (1,250 m.).
Take-off distance to 50 ft. (15.2 m.) (three engines) 1,865 yds. (1,705 m.).
Landing distance from 50 ft. (15.2 m.) 1,125 yds. (1,030 m.).

HANDLEY PAGE (READING)

HANDLEY PAGE (READING), LTD.

REGISTERED OFFICE: CRICKLEWOOD, LONDON, N.W.2.

WORKS: WOODLEY, NEAR READING, BERKS.

Directors: Sir Frederick Handley Page, C.B.E. (Chairman and Managing), Air Cdre. A. Vere Harvey, C.B.E., M.P. (Deputy Chairman), G. C. D. Russell, A.F.R.Ae.S. (Assistant Managing Director), G. R. Volkert (Technical Director), A. A. Lough, F.C.A. and F. S. Gaylor.

Chief Designer: E. Gray, B.Sc., A.M.I.Mech.E., A.F.R.Ae.S.

Secretary: J. H. S. Green, A.C.A.

Handley Page (Reading), Ltd. was formed in June, 1948, after negotiation between Handley Page, Ltd. and the Receiver for the debenture-holders of Miles Aircraft, Ltd.

Handley Page (Reading), Ltd. acquired the production rights of the Marathon feeder-line transport and undertook the quantity production of this aircraft.

New civil and military aircraft are being developed by the Handley Page (Reading) design office.

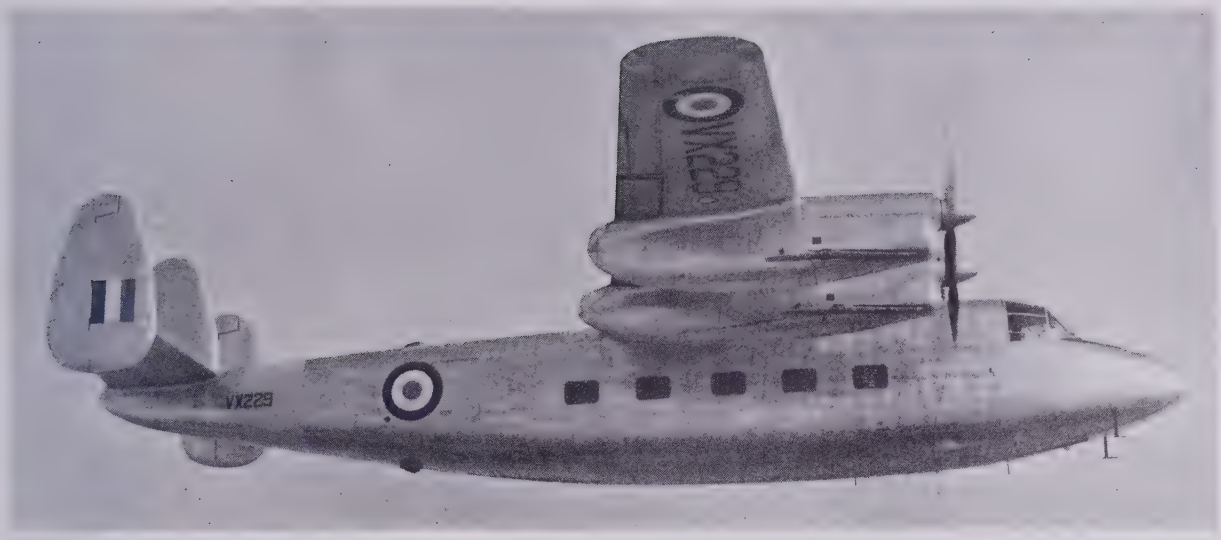
THE HANDLEY PAGE MARATHON 1.

The Marathon was designed by Miles Aircraft, Ltd. as a medium-range feeder-line aircraft, and production has been undertaken by Handley Page (Reading) Ltd. at Woodley. Marathons have been delivered to West African Airways Corporation (six) and the Union of Burma Airways (three).

Thirty Marathons are being supplied to the Royal Air Force as advanced navigation trainers under the designation T. Mk. 11. Each of these aircraft will carry a crew consisting of pilot, signaller, navigator instructor and two student navigators; the last three in aft-facing seats. Instructional equipment will



The Handley Page Marathon 1 Feeder-line Transport (four 340 h.p. D.H. Gipsy Queen engines).



The Handley Page Marathon T. Mk. 11 Navigation Trainer (four 340 h.p. D.H. Gipsy Queen engines).

include Rebecca Mk. 4, Gee and radio compass.

The description and specification which follows refers to the Marathon I Civil aircraft.

TYPE.—Four-engined 18/22-passenger monoplane.

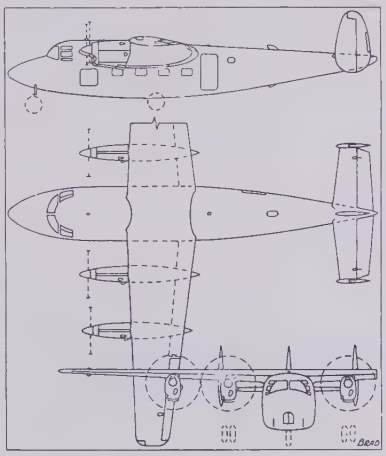
WINGS.—Cantilever high-wing monoplane. Aerofoil section NACA 23018 (root); NACA 23009 (tip). Aspect ratio 8.48. Root chord 10 ft. 1 in. (19.81 m.), tip chord 4 ft. 8.6 in. (1.44 m.). Dihedral 1.4° at C/L. of spar. Incidence 4.5° constant to outer wing joints and 2° washout to tips. All-metal single-spar stressed skin structure. All-metal ailerons with controllable trim-tab in each. Retractable Miles auxiliary high-lift flaps between ailerons and fuselage. Pneumatic operation with emergency standby air control. Total area of ailerons 30.2 sq. ft. (2.80 m.²). Total area of flaps 65 sq. ft. (6.04 m.²). Gross wing area 498 sq. ft. (46.31 m.²).

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—All-metal cantilever structure with three fins and two rudders mounted as endplates to tailplane. Trim-tabs in port rudder and elevators; servo-tabs in starboard rudder and elevator. Gross fin area 76.56 sq. ft. (7.11 m.²). Total rudder area 27.44 sq. ft. (2.55 m.²). Total elevator area 39.13 sq. ft. (3.63 m.²). Gross tailplane area 59.87 sq. ft. (5.56 m.²).

LANDING GEAR.—Retractable tricycle type. Each main unit consists of Miles levered suspension oleo-pneumatic shock-absorber leg and dual Dunlop wheels. Pneumatic retraction. Dunlop pneumatic brakes on main wheels. Nose-wheel of same size as and interchangeable with main wheels. Rear bumper skid consists of rubber unit with metal sheath. Track 17 ft. 4 in. (5.28 m.). Wheelbase (static) 17 ft. 3 in. (5.26 m.).

POWER PLANT.—Four 340 h.p. D.H. Gipsy Queen 70-3 (Mk. 1) or 70-4 (Mk. 1A) six-cylinder in-line inverted air-cooled engines. De Havilland Hydromatic three-blade constant-speed full-feathering airscrews, 7 ft. 6 in. (2.28 m.) diameter. Four flexible fuel tanks each of 55 Imp. gallon (250 litres) capacity, two in each centre section with provision for additional tankage to a total of 280 Imp. gallons (1,273 litres). Oil capacity 24 Imp. gallons (109.1 litres).



The Handley Page Marathon I.

ACCOMMODATION.—Crew of two; pilot and co-pilot/navigator side-by-side with dual controls. Co-pilot's seat and controls removable to allow permanent installation of navigator's table. Aft of pilot's compartment is forward luggage compartment with capacity of 104 cub. ft. (2.95 m.³). Access hatch 2 ft. 6 in. (0.76 m.) square on port side of fuselage. Main cabin follows with capacity for 18-22 passengers or can be used solely for freight. Cabin is 18 ft. long × 7 ft. 9 in. wide × 6 ft. 2 in. high (mean height) (5.49 × 2.36 × 1.83 m.), capacity 760 cub. ft. (21.5 m.³). Cabin is air conditioned and thermostatically heat controlled. Entry door 5 ft. 2 in. × 2 ft. 6 in. (1.6 × 0.76 m.) on port side under wing trailing-edge. Cabin floor 2 ft. 5 in. (0.75 m.) from ground. Emergency escape hatch in roof. Rear luggage compartment aft of cabin with capacity of 146 cub. ft. (4.12 m.³). Loading hatch on starboard side 3 ft. 6 in. long × 3 ft. 1 in. high (1 m. × 0.94 m.).

DIMENSIONS.—
- Span 65 ft. 0 in. (19.81 m.).
- Length 52 ft. 1½ in. (15.87 m.).
- Height 14 ft. 1 in. (4.4 m.).

WEIGHTS AND LOADINGS.—
- Basic equipped weight (18-seat version) 12,244 lb. (5,560 kg.).
- Total disposable load 5,756 lb. (2,613 kg.).
- Weight loaded 18,000 lb. (8,165 kg.).
- Wing loading (at loaded weight) 36.14 lb./sq. ft. (176.5 kg./m.²).
- Power loading (at loaded weight, take-off power) 13.24 lb./h.p. (6.01 kg./h.p.).

PERFORMANCE (at 18,000 lb. = 8,165 kg. A.U.W.).—
- Max. speed 232.5 m.p.h. (374 km.h.) at 6,750 ft. (2,060 m.).
- Max. weak mixture cruising speed 192 m.p.h. (307 km.h.) at 5,000 ft. (1,525 m.), 201 m.p.h. (322 km.h.) at 10,000 ft. (3,050 m.) and 174 m.p.h. (278 km.h.) at 14,800 ft. (4,510 m.).
- Initial rate of climb 615 ft./min. (188 m./min.) (Mk. 1), 815 ft./min. (248 m./min.) (Mk. 1A).
- Initial rate of climb (3 engines) 220 ft./min. (67 m./min.) (Mk. 1), 360 ft./min. (110 m./min.) (Mk. 1A).
- Service ceiling 16,500 ft. (5,120 m.).
- Absolute ceiling 18,000 ft. (5,490 m.).
- Range at max. weak mixture cruising power at 192 m.p.h. (307 km.h.) at 5,000 ft. (1,525 m.) with 4,172 lb. (1,895 kg.) payload and 220 Imp. gal. (1,000 litres) fuel 634 miles (1,015 km.); with 3,740 lb. (1,700 kg.) payload and 280 Imp. gal. (1,275 litres) fuel 935 miles (1,496 km.).
- Range at 2,000 r.p.m. at 157.5 m.p.h. (252 km.h.) at 5,000 ft. (1,525 m.) with 4,172 lb. (1,895 kg.) payload at 220 Imp. gal. (1,000 litres) fuel 720 miles (1,150 km.); with 3,740 lb. (1,700 kg.) payload and 280 Imp. gal. (1,275 litres) 935 miles (1,496 km.).
- Take-off distance to 50 ft. (15.2 m.) 920 yds. (842 m.).
- Landing distance from 50 ft. (15.2 m.) 790 yds. (723 m.).

HAWKER

HAWKER AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: KINGSTON-ON-THAMES, SURREY.

AERODROMES AND OTHER FACTORIES: LANGLEY, BUCKS., DUNSFOLD, SURREY, AND SQUIRE'S GATE, BLACKPOOL, LANCS.

Established: 1933.

Chairman: Sir Frank Spencer Spriggs, K.B.E., Hon.F.R.Ae.S.

Directors: Sir Thomas O. M. Sopwith, K.B., C.B.E., Hon. F.R.Ae.S., A. N. Spriggs, O.B.E., M.I.P.E. (General Manager), Sir Sydney Camm, K.B., C.B.E., F.R.Ae.S. (Chief Designer), E. H. Jefferson (Works Director), J. T. Libdury, J.P. (Secretary).

Hawker Aircraft, Ltd., was incorporated in 1933 as successor to the H. G. Hawker Engineering Co., Ltd., which was formed in 1920 as the outcome of the voluntary liquidation of the famous Sopwith concern.

The Hawker company produced during the last war a distinguished line of single-seat fighters, of which the Hurricane, the Typhoon, and the Tempest were the best known. From the Tempest was developed the Fury and Sea Fury, both of which have been produced in numbers since the war.

The current types of Hawker aircraft are the Hunter which is in super-priority production for the Royal Air Force and for N.A.T.O.; the Sea Fury, which is in service in the Royal Navy and has been ordered by N.A.T.O.; and the Sea Fury which is in service in the Royal Navy, the Royal Australian Navy, the Royal Canadian Navy and the Royal Netherlands Navy, and is still in production.

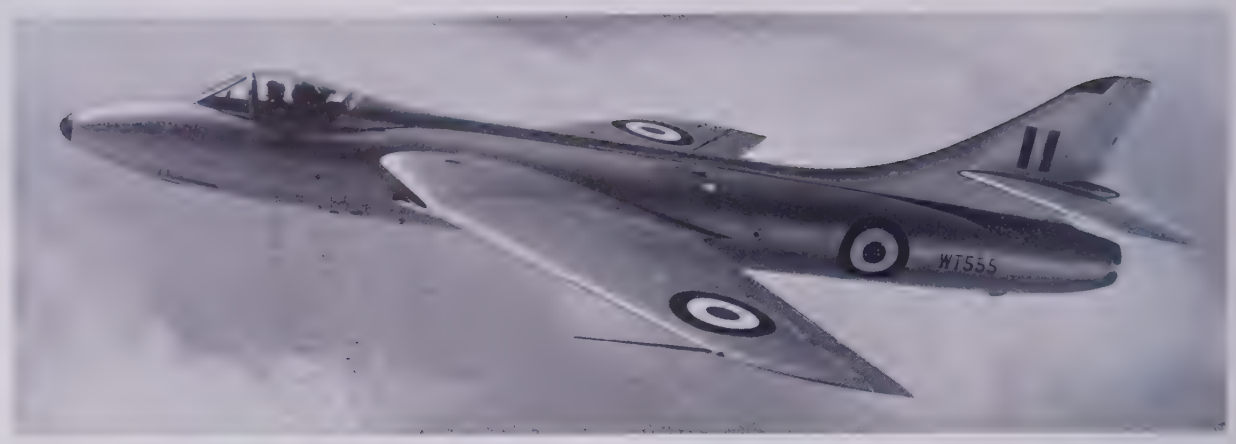
THE HAWKER HUNTER.

The Hunter is a swept-wing single-seat fighter which is in production for the Royal Air Force and for N.A.T.O.

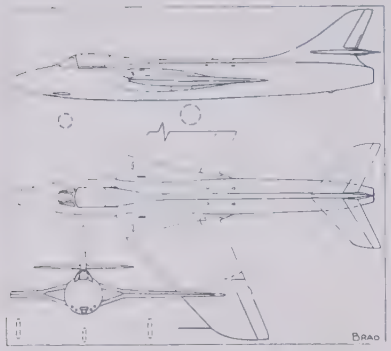
Two versions of the Hunter have so far been announced. These are:—

Hunter F. Mk. 1. One Rolls-Royce Avon turbojet engine. Provision for afterburner. Prototype first flew on July 20, 1951.

Hunter F. Mk. 2. One Armstrong Siddeley Sapphire turbojet engine. Prototype made its first flight on November 30, 1952.



The production Hawker Hunter F. Mk. 1 Single-seat Fighter (Rolls-Royce Avon turbojet engine).



The Hawker Hunter F. Mk. 1.

No details of the Hunter had been released for publication at the time of writing, but its external characteristics can be gathered from the accompanying illustrations.

THE HAWKER P.1052.

The P.1052 was built as a research aircraft to investigate, among other things, the behaviour of swept-back wings at low speed from the points of view of controllability and stability. The first flight was made on November 19, 1948.

In 1951, the P.1052 was modified as a naval aircraft with arrester-gear and other specialised equipment. More recently the aircraft has been fitted with a swept-back tailplane and test flying continues.

A structural description of the P.1052 was published in the 1951-52 edition of this Annual.

DIMENSIONS.—
Span 31 ft. 6 in. (9.6 m.).
Length 37 ft. 9.5 in. (11.5 m.).
Height 10 ft. 1 in. (3.07 m.).

WEIGHTS AND PERFORMANCE.—
No data available.

THE HAWKER SEA HAWK.

TYPE.—Single-seat Naval Fighter.

WINGS.—Cantilever mid-wing monoplane. All-metal structure with stressed heavy-gauge skin. Outer wings attached to stub wings by two hinge fittings with automatic locks and a spigot bearing in the leading-edge, and are power-folded. All-metal ailerons with spring tabs. Combined hydraulically-operated landing and brake flaps of double split type inboard of ailerons. Gross wing area 278 sq. ft. (25.8 m.²). Flap area 50 sq. ft. (4.5 m.²). Aspect ratio 5.5. Dihedral root to tip 4½ degrees. Incidence +½ degrees.

FUSELAGE.—All-metal structure. Nose and centre portions are of semi-monocoque construction reinforced by a box-section keel member and four longerons; the rear portion is a pure monocoque of which the fin base is an integral part. Fuselage is stressed for tail-down accelerated take-offs; single take-off point beneath fuselage.

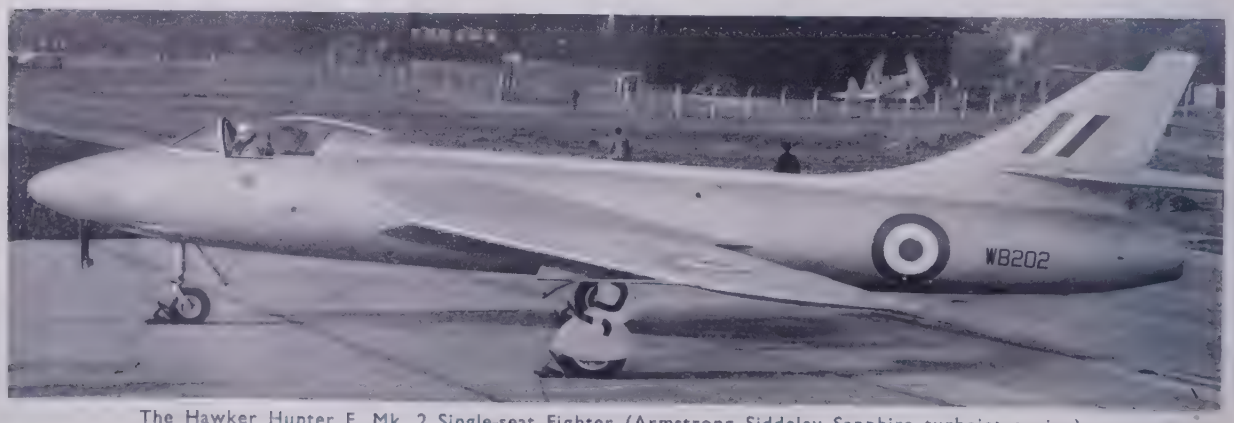
TAIL UNIT.—All-metal cantilever structure. Tailplane, of one-piece multi-spar construction, passes through fin above fuselage. Controllable trim-tabs in elevators. Total horizontal area 38.6 sq. ft. (3.59 m.²). Total vertical area 33.1 sq. ft. (3.04 m.²).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Dowty liquid-spring shock-absorber struts to all wheels. Sting-type arrester hook in rear fuselage. Track 8 ft. 6 in. (2.6 m.).

POWER PLANT.—One 5,000 lb. (2,270 kg.) s.t. Rolls-Royce Nene 4 gas-turbine in centre



The Hawker Hunter F. Mk. 1 Single-seat Fighter.



The Hawker Hunter F. Mk. 2 Single-seat Fighter (Armstrong Siddeley Sapphire turbojet engine).



The Hawker Sea Hawk F. Mk. I Single-seat Naval Fighter (Rolls Royce Nene turbojet engine).

fuselage. Air intakes in wing leading-edge roots, exits on wing trailing-edge roots, each side of fuselage. Boundary layer bleed at junction with fuselage side. Spring-loaded doors in top surface of centre fuselage provide additional air intakes when the engine is ground running and for take-off. As pressure in the plenum chamber increases, these doors close automatically. Fuel tanks in fuselage, with provision for under-wing drop tanks.

ACCOMMODATION.—Pilot in pressurised cockpit well forward in nose of fuselage, with three-piece windscreen, including an optically-flat bullet-proof centre section, and single-piece jettisonable canopy. Martin-Baker ejector seat for pilot. Canopy can be jettisoned in conjunction with seat or by itself.

ARMAMENT. Four 20 mm. cannon mounted in lower portion of fuselage nose.

DIMENSIONS.—
Span 39 ft. (11.9 m.).
Width folded 13 ft. 4 in. (4.04 m.).
Length 39 ft. 7 in. (12.1 m.).
Height 8 ft. 8 in. (2.65 m.).
Height (wing folded) 16 ft. 10 in. (5.1 m).

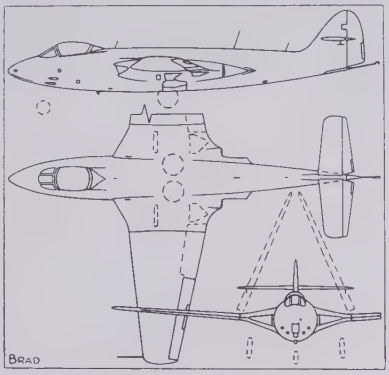
WEIGHTS AND PERFORMANCE.—
No data available.

THE HAWKER SEA FURY.

The Sea Fury, which is still in operational service in the Royal Navy, the Royal Australian Navy, the Royal Canadian Navy and the Royal Netherlands Navy, is the last piston-engined fighter to be built in quantity in the United Kingdom. It has also been built by Fokker for the Royal Netherlands Navy.

The following are the principal versions of the Sea Fury :—

Sea Fury F. Mk. 10. First production version. First prototype with Centaurus 15 engine, subsequent aircraft with the Centaurus 18. Fifty built for Royal Navy.



The Hawker Sea Hawk F. Mk. I.

Sea Fury F.B. Mk. 11. Fifty-first production aircraft *et seq.* Similar to F. Mk. 10 but embodying all the small internal modifications introduced progressively in the first 50 airframes. Supplied to the Royal Navy, Royal Canadian Navy and Royal Australian Navy.

Sea Fury T. Mk. 20. Two-seater trainer version of the Mk. 10. One 20 mm. cannon is deleted from each wing to allow for the installation in the wing of equipment displaced from the fuselage by the second cockpit. Mirror mounted on tripod between cockpit to permit the instructor to use reflector gunsight over head of pupil. This tripod can be quickly removed when the aircraft is not being used for gunnery training. Bombs and rockets or long-range drop tanks can be carried beneath the wings as on the F.B. Mk. 11.

Sea Fury F.B. Mk. 51. Supplied to the Royal Netherlands Navy. Similar to Sea Fury F.B. Mk. 11, but has Dutch language instruments, etc.

TYPE.—Single-seat Naval Fighter or Photographic Reconnaissance monoplane.

WINGS.—All-metal cantilever low-wing monoplane. Outer planes, fold upwards hydraulically, controlled from cockpit. Gross wing area 280 sq. ft. (26 m.²). All-metal modified Frise-type mass-balanced ailerons. Inset trim-tab and Hawker patent spring-tab in each aileron. Total aileron area 18.03 sq. ft. (1.677 m.²). Hydraulically-operated split trailing-edge flaps in two sections each side. Flap area (total) 31.4 sq. ft. (2.92 m.²).

FUSELAGE.—All-metal structure.

TAIL UNIT.—All-metal cantilever structure. Pre-stretched sheet metal covering over all surfaces. Tailplane span 14 ft. 0 in. (4.26 m.). Tailplane area 51.0 sq. ft. (4.74 m.²). Elevator area (both aft of hinge) 13.62 sq. ft. (1.26 m.²). Rudder area 13.2 sq. ft. (1.23 m.²). Fin area 13.5 sq. ft. (1.25 m.²).

LANDING GEAR.—Retractable tail-wheel type. Dowty levered-suspension oleo-pneumatic shock-absorber legs. Hydraulic operation. Track 12 ft. 0 in. (3.66 m.). Tail-wheel on Dowty oil-compression shock-absorber leg. Dunlop tyres and Dunlop pneumatically-operated differential brakes on main wheels. Sting-type arrester hook beneath rudder.

POWER PLANT.—One 2,470 h.p. Bristol Centaurus 18 eighteen-cylinder two-row radial sleeve-valve air-cooled engine driving a Rotol five-blade constant-speed metal airscrew 12 ft. 9 in. (3.88 m.) diameter. Total internal fuel capacity 200 Imp. gallons (909 litres). Two 45 Imp. gallon (204 litre) or 90 Imp. gallon (409 litre) drop-tanks may be carried under wings. Oil tank (of 14 Imp. gallons = 64 litres) behind engine bulkhead.

ACCOMMODATION.—Pilot's cockpit over wing with one-piece blown Perspex canopy which slides for access and can be jettisoned. Fixed bullet-proof windscreen. Double-armoured bulkhead behind pilot with $\frac{5}{8}$ in. (1.7 cm.) slab for head and neck protection. Dinghy stowage under pilot's seat.



The Hawker Sea Fury F.B. Mk. 11 Single-seat Naval Fighter (2,550 h.p. Bristol Centaurus 18 engine).



The Hawker Sea Fury T. Mk. 20 Advanced Trainer (2,550 h.p. Bristol Centaurus 18 engine).

ARMAMENT.—Four 20 mm. British Hispano Mk. 5 cannon mounted two in each wing. Magazines in wings have total of 580 rounds. Gyro gun-sight. Racks below wings for two 500 lb. (227 kg.) or 1,000 lb. (454 kg.) bombs, twelve 3 in. (7.62 cm.) or 5 in. (12.7 cm.) rocket projectiles with 60 lb. (27 kg.) heads, or four Triplex rocket projectiles with 180 lb. (82 kg.) heads. Racks or L.S. carriers with eight 8½ lb. (3.85 kg.) practice bombs. P.R. version carries two F.24 cameras (one vertical and one oblique) in fuselage.

DIMENSIONS.—
Span 38 ft. 4¾ in. (11.69 m.).
Length 34 ft. 8 in. (10.56 m.).

WEIGHTS AND LOADINGS.—
Weight empty 8,997 lb. (4,090 kg.).
Equipment 1,587 lb. (720 kg.).
Pilot and parachute 200 lb. (91 kg.).
Fuel and oil (normal) 1,566 lb. (710 kg.).
Normal weight loaded 12,350 lb. (5,602 kg.).
Wing loading 44.1 lb./sq. ft. (215 kg./m.²).
Power loading at take-off 5.0 lb./h.p. (2.27 kg. h.p.).

PERFORMANCE (F.B. Mk. 11).—
Max. speed 450 m.p.h. (727 km.h.) at 20,000 ft. (6,100 m.).
Speed at 30,000 ft. (9,150 m.) 415 m.p.h. (670 km.h.).
Initial rate of climb (combat rating) 4,320 ft./min. (1,320 m./min.).
Climb at 20,000 ft. (6,100 m.) 2,850 ft./min. (670 m./min.).
Climb (at combat rating) to 16,000 ft. (4,880 m.) 4.35 minutes.
Climb to 20,000 ft. (6,100 m.) 5.7 minutes.
Climb to 30,000 ft. (9,145 m.) 10.8 minutes.
Radius of action (estimated) at max. economic cruising speed with max. fuel and with 15 minutes combat allowance 720 miles (1,160 km.) at 10,000 ft. (3,050 m.).
Deck take-off run at 12,350 lb. (5,602 kg.) in 31 m.p.h. (50 km.h.) wind 500 ft. (153 m.).
Still air take-off distance 960 ft. (293 m.).

PERFORMANCE (T. Mk. 20).—
Max. speed 370 m.p.h. (597 km.h.) at sea level, 415 m.p.h. (669 km.h.) at 7,500 ft. (2,280 m.) and 445 m.p.h. (717 km.h.) at 20,000 ft. (6,100 m.).
Rate of climb at 5,500 ft. (1,675 m.) 4,300 ft./min. (21.8 m./sec.).
Climb to 5,500 ft. (1,675 m.) in 1.3 min., to 15,000 ft. (4,575 m.) in 4.05 min., to 20,000 ft. (6,150 m.) in 5.65 min.
Max. range 1,630 miles (2,620 km.).
Deck take-off run with drop tanks, in 31 m.p.h. (50 km.h.) wind 600 ft. (183 m.).
Still air take-off distance 1,150 ft. (350 m.).

HAWKER SIDDELEY

HAWKER SIDDELEY GROUP, LTD.

GROUP HEADQUARTERS: 18, ST. JAMES'S SQUARE, LONDON, S.W.1.

Directors: Sir Thomas Sopwith, K.B., C.B.E., Hon. F.R.Ae.S. (Chairman), Sir Frank Spencer Spriggs, K.B.E., Hon. F.R.Ae.S. (Managing Director), H. Burroughes, F.R.Ae.S. (Deputy Managing Director), Sir Roy Dobson, C.B.E., F.R.Ae.S., H. A. Meredith, O.B.E., H. T. Chapman, C.B.E., M.I.Mech.E., F.R.Ae.S. and J. F. Robertson, C.A.

The Hawker Siddeley Group, which was formed in 1935, is the controlling organisation of Hawker Aircraft. Ltd., Hawker Aircraft (Blackpool), Ltd., Gloster Aircraft Co., Ltd., Sir W. G. Armstrong Whitworth Aircraft, Ltd., A. V. Roe & Co., Ltd., A. V. Roe Canada, Ltd., Armstrong Siddeley Motors, Ltd., Brockworth Engineering Co., Ltd., Air Service Training Ltd., High Duty Alloys, Ltd., and several other subsidiary and associate companies whose work is not directly related to aircraft.

Products of the aircraft and aero-engine manufacturing components of the Group will be found under their individual names in this and the Engine Sections of this book.

MARTIN-BAKER

MARTIN-BAKER AIRCRAFT CO., LTD.

HEAD OFFICE AND WORKS: HIGHER DENHAM, NEAR UXBRIDGE, MIDDLESEX.

Managing Director and Chief Designer: James Martin, O.B.E., F.R.Ae.S.

The Martin-Baker Aircraft Co., Ltd., was formed in 1934 to exploit a special system of steel-tube construction evolved by Mr. James Martin. This construction was embodied in the Company's first production, the M.B.1, which was described and illustrated in the 1936 Edition of this work.

In 1939 details were released concerning an experimental single-seat eight-gun fighter monoplane, the M.B.2, which the Company built to the order of the Air Ministry. This machine made use of the Martin system of steel-tube construction. Brief details of this aircraft were published in the 1940 Edition.

Two further prototype fighters completed, both meeting the F. 18/39 Specification were the M.B.3 with a Napier Sabre engine which first flew on August 31, 1942, and the M.B.5 with a Griffon 83 engine driving contra-rotating airscrews. A full description of the M.B.5, which flew for the first time on May 23, 1944, appeared in the 1947 Edition.

Since 1944 the company has specialised in the design and manufacture of ejection seats. These have now been supplied for over twenty different types of aircraft in all parts of the World. The Martin-Baker ejection seat has been adopted as standard equipment by the Royal Air Force.

The company has concluded arrangements with the Société Nationale de Constructions Aéronautiques du Sud-Ouest (SNCASO) and with the Service Technique du Departement Militaire Fédéral for the manufacture of Martin-Baker ejection seat in France and Switzerland respectively.

The company has now tested and perfected a new type of automatic seat which operates in such a way that when a pilot is shot out his main canopy is developed by automatic means, so that he has nothing further to do after his ejection.

In addition, the firm manufactures in quantity the Martin patent gun feed for the 20 mm. Hispano cannon, and various other items of armament and airscrew equipment.

PERCIVAL

PERCIVAL AIRCRAFT, LTD.

HEAD OFFICE AND WORKS: LUTON AIRPORT, LUTON, BEDFORDSHIRE.

Directors: P. Ll. Hunting (Chairman), G. L. Hunting, C. P. M. Hunting, W. A. Summers (Managing), K. D. Morgan (Secretary), R. R. S. Cook, T. Fraser, L. G. Frise, B.Sc., F.R.Ae.S., A.F.I.Ae.S. (Technical) and L. C. Hunting.

The Percival Aircraft Company was formed in 1932. It was re-organized as Percival Aircraft Ltd. in 1937, and the works were moved from Gravesend to Luton. A branch office was opened at Toronto, Canada, in 1946.

Since the end of the war, the company has produced the Proctor V, a four-seat private, club and charter aircraft, the Prentice basic trainer for the Royal Air Force, and the Prince twin-engined commercial monoplane, including a version specially designed for air survey work.

A new basic trainer, the Provost, has been selected by the Royal Air Force as standard equipment for all R.A.F. Flying Training Schools and is now in service. The Provost has also been ordered by the Southern Rhodesian Air Force. A jet version of the Provost is under development.

Developments of the Civil Prince are the Sea Prince, in service with the Royal Navy for communications and crew training, and the Pembroke, adopted by the Royal Air Force and also ordered by the Southern Rhodesian Air Force and the Belgian Air Force.

Civil Princes are in operation in England, Australia, Thailand, Borneo, Venezuela, Switzerland, South Africa, Brazil,

Tanganyika and the U.S.A., and deliveries by air have been made across the Atlantic to North and South America.

The Company is also engaged on the development of helicopters.

THE PERCIVAL P.84 JET PROVOST.

The P.84 is a two-seat side-by-side *ab-initio* jet trainer development of the Provost T. Mk. 1, a number of which are being built for the Ministry of Supply.

It uses the same wings and tail-unit as the Provost but has a new front and centre fuselage and a nose-wheel landing-gear. The power-unit, an Armstrong Siddeley Viper long-life turbojet engine (1,600 lb.=726 kg. s.t.), is installed in the fuselage aft of the cockpit with "elephant-ear" air intakes in the sides of forward fuselage and the jet exit below the fuselage aft of the trailing-edge of the wings. Fuel is carried in six wing tanks, the total capacity being 180 Imp. gallons (817 litres).

The cockpit layout is similar to that of the Provost T. Mk. 1.

DIMENSIONS.—
Span 35 ft. 2 in. (10.72 m.).
Length 31 ft. 6 in. (9.60 m.).
Height 11 ft. 0 in. (3.35 m.).

WEIGHT LOADED (Designed).—
5,100 lb. (2,315 kg.).

PERFORMANCE.—
No data available.

THE PERCIVAL P.56 PROVOST.

The P.56 trainer was designed to Specification T.16/48 to meet R.A.F. requirements. Three prototypes were built, one fitted with the Armstrong Siddeley Cheetah 18 engine and the other two with the Alvis Leonides engine. The first (Cheetah-engined) prototype flew for the first time on February 23, 1950.

As the result of comprehensive trials the Leonides-engined P.56 was selected as the future R.A.F. basic trainer under the designation Provost T. Mk. 1. This aircraft is now in full production.

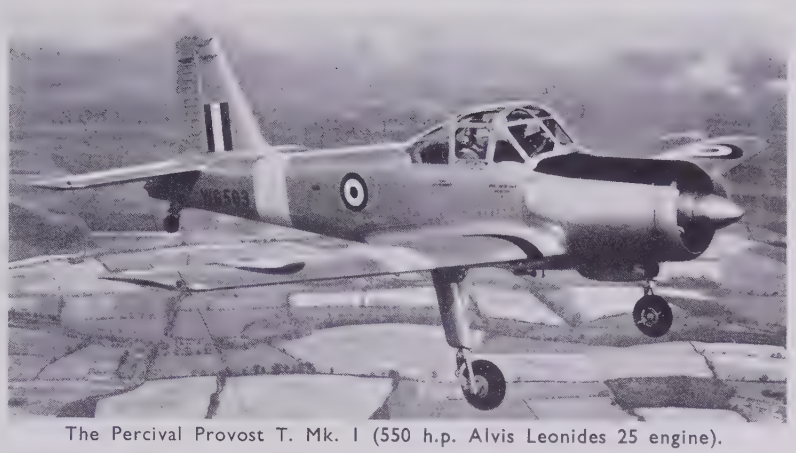
TYPE.—Two-seat Basic Trainer.

WINGS.—Cantilever low-wing monoplane. Wing section NACA 23015 (mod.) at root, NACA 4412 (mod.) at tip. Aspect ratio 5.78. Dihedral 6°. Incidence 3°. All-metal stressed skin construction. Metal covered ailerons and trim tabs. Pneumatically-operated slotted flaps. Total flap area 18.94 sq. ft. (1.74 m.²). Gross wing area 214 sq. ft. (20 m.²).

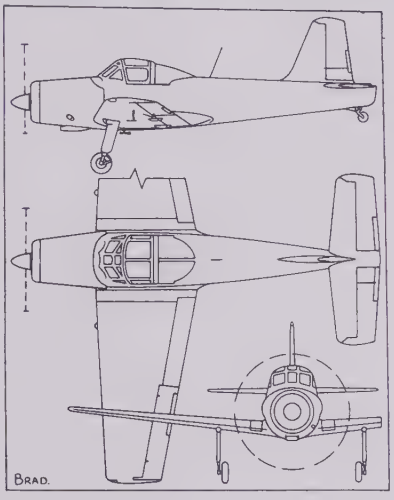
FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal one-piece tailplane, interchangeable elevators, fin and rudder, the fixed surfaces covered with smooth and movable surfaces with fluted alloy skin. Trim and balance tabs in elevators, combined trim and balance tab in rudder. Span of tailplane 13 ft. 6 in. (4.1 m.). Total horizontal area 48.6 sq. ft. (4.51 m.²). Total vertical area 35.09 sq. ft. (3.26 m.²).

LANDING GEAR.—Fixed tail-wheel type. British Messier oleo-pneumatic shock-absorbers. Differential pneumatic brakes.



The Percival Provost T. Mk. 1 (550 h.p. Alvis Leonides 25 engine).



The Percival Provost T. Mk. 1.

Dowty liquid-spring tail-wheel strut. Track 11 ft. 1½ in. (3.38 m.).

POWER PLANT.—One 550 h.p. Alvis Leonides 25 nine-cylinder air-cooled geared and supercharged radial engine. Three-blade metal constant-speed airscrews, 9 ft. (2.74 m.) diameter. Fuel capacity 66 Imp. gallons (300 litres).

ACCOMMODATION.—Crew of two in enclosed cockpit. Instructor (on starboard) and pupil sit side-by-side, with full dual controls and dual instrument panels. Sliding canopy is mechanically-operated and jettisonable.

DIMENSIONS.—
Span 35 ft. 2 in. (10.9 m.).
Length 29 ft. (8.85 m.).
Overall height (tail up) 12 ft. (3.66 m.).

WEIGHTS AND LOADINGS.—
Weight empty (equipped) 3,350 lb. (1,521 kg.).
Crew (2) 400 lb. (182 kg.).
Fuel and oil 529 lb. (240 kg.).
Weight loaded 4,400 lb. (2,000 kg.).
Wing loading 20.6 lb /sq ft. (100.5 kg./m.²).
Power loading 8.0 lb./h.p. (3.63 kg./h.p.).

PERFORMANCE.—
Max. speed 195 m.p.h. (312 km.h.) at sea level and 200 m.p.h. (322 km.h.) at 2,300 ft. (700 m.).
Max. continuous cruising speed 194 m.p.h. (310 km.h.) at 7,900 ft. (2,410 m.).
Max. economical cruising speed 177 m.p.h. (283 km.h.) at 11,500 ft. (3,510 m.).
Stalling speed, flaps down 67 m.p.h. (108 km.h.).
Initial rate of climb 2,200 ft./min. (11.2 m./sec.).
Rate of climb at 5,000 ft. (1,525 m.) 1,870 ft./min. (9.5 m./sec.).
Climb to 5,000 ft. (1,525 m.) 3.3 minutes.
Climb to 10,000 ft. (3,050 m.) 7.0 minutes.
Rate of roll (per second) 90 degrees.
Service ceiling 22,500 ft. (6,860 m.).
Take-off to 50 ft. (15.2 m.), grass surface 283 yds. (260 m.).
Landing run 265 yds. (242 m.).
Duration (at economical weak cruise) 4 hrs.

THE PERCIVAL P.50 PRINCE III.

The Prince, designed mainly for feeder-line and executive travel, first flew at Luton on May 13, 1948. The Prince Series I had an all-up weight of 10,650 lb. (4,835 kg.) and was powered with two 520 h.p. Alvis Leonides 501/4 engines. The Series II and current production Series III have an all-up weight of 11,000 lb. (4,994 kg.).

A new civil Prince, based on the R.A.F. Pembroke and to be known probably as the Prince Series V, is under consideration for production. With an all-up weight of 12,500 lb. (5,675 kg.), the new Prince would provide considerably increased payload and range. It would be to the same general configuration as the Pembroke with increased span (64 ft. 6 in.= 19.67 m.) and dual main landing wheels.



The Percival P.50 Prince III Light Transport (two 550 h.p. Alvis Leonides engines).



The Percival P.50 Prince III Light Transport (two 550 h.p. Alvis Leonides engines).

The description below refers to the currently-produced Prince Series III.

TYPE. Twin-engined High-wing monoplane for Feeder-line, Charter and Freight-carrying duties.

WINGS. Cantilever high-wing monoplane. Aspect ratio 8.6. All-metal two-spar stressed-skin structure. Detachable tips. All-metal ailerons. Trim-tab in port aileron and geared tab in starboard. NACA slotted flaps. Leading-edges of wings may be fitted with Goodrich pulsating de-icer boots. Gross wing area 365 sq. ft. (33.9 m.²).

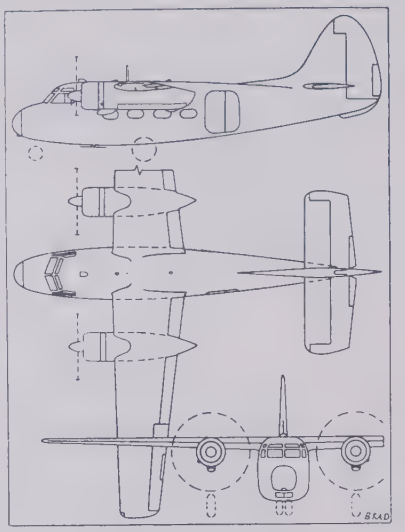
FUSELAGE.—All-metal monocoque structure in two main sections. Nose detachable for access to controls, instruments and electrical gear.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with fixed surfaces covered with smooth and movable surfaces with fluted light alloy skin. Tailplane and fin may be fitted with Goodrich de-icer boots. Span of tail 18 ft. 9 in. (5.71 m.). Trim and geared tabs in elevators and rudder.

LANDING GEAR.—Retractable tricycle type. Oleo-pneumatic shock-absorbers. Non-steerable self-centering nose-wheel. Pneumatic retraction, with emergency gear. Pneumatic brakes on main wheels. Track 16 ft. 6 in. (5.0 m.).

POWER PLANT. Two 550 h.p. Alvis Leonides 24 (502/4) nine-cylinder radial air-cooled engines. De Havilland three-blade constant-speed feathering and braking airscrews 9 ft. (2.74 m.) diameter. Normal fuel in four interconnected crashproof tanks in wings, inner tanks having 53 Imp. gals. (242 litres) capacity each and outer tanks 33.5 Imp. gals. (152 litres) each. Total standard fuel capacity 173 Imp. gals. (786 litres). Provision for fitting 60 Imp. gals. (274 litres) outer wing tanks in lieu of standard 33.5 gal. tanks. 100 Imp. gals. (455 litres) long-range ferrying tank may be installed in fuselage. 7.3 Imp. gal. (33 litre) oil tank in each engine nacelle.

ACCOMMODATION. Crew of two side-by-side with provision for dual controls. Entry door in bulkhead aft of cockpit. Main passenger cabin 15 ft. 0 in. long × 5 ft. 6 in. wide × 6 ft. 0 in. high (4.57 × 1.68 × 1.8 m.) with entry door 5 ft. 0 in. × 2 ft. 3 in. (1.68 × 6.8 m.) at rear on port side. Standard cabin interior arrangement has seats for eight passengers with central gangway 14½ in. (37 cm.) wide. Overhead racks for personal luggage. Toilet compartment at rear on starboard side opposite main entry door. Aft of toilet is baggage compartment with floor area of 12.7 sq. ft. (1.18 m.²) and capacity of 72 cub. ft. (2.04 m.³). Access by door immediately adjacent to passenger door. With toilet bulkhead and fittings removed two or four additional passenger seats can be installed or alternatively all interior equipment can be removed and entire cabin space used for freight-carrying. Built-in tie-down fittings, which do not project into passenger accommodation.



The Percival P.50 Prince III.

DIMENSIONS.—
Span 56 ft. (17.3 m.).
Length 42 ft. 10 in. (13 m.).
Height over rudder 16 ft. 1 in. (4.9 m.).

WEIGHTS AND LOADINGS (Standard 8-passenger version).—
Weight empty (equipped) 8,038 lb. (3,649 kg.).
Crew (2) 340 lb. (154 kg.).
Fuel and oil 853 lb. (387 kg.).
Passengers (8) 1,360 lb. (617 kg.).
Luggage and freight 409 lb. (185 kg.).
Weight loaded 11,000 lb. (4,989 kg.).
Wing loading 30.1 lb./sq. ft. (147 kg./m.²).
Power loading 10 lb./h.p. (4.47 kg./h.p.).

PERFORMANCE (at 11,000 lb. = 4,989 kg.).—
Max. speed 223 m.p.h. (359 km.h.) at sea level and 229 m.p.h. (368 km.h.) at 5,000 ft. (1,050 m.).
Max. rich mixture cruising speed 197 m.p.h. (315 km.h.) at sea level 212 m.p.h. (341 km.h.) at 5,000 ft. (1,525 m.).
Max. weak mixture cruising speed 166 m.p.h. (267 km.h.) at sea level, 178 m.p.h. (286 km.h.) at 5,000 ft. (1,525 m.).
Stalling speed, power off, flaps down 75 m.p.h. (121 km.h.).
Initial climb 1,650 ft./min. (8.25 m./sec.).
Service ceiling 23,400 ft. (7,140 m.).
Service ceiling (one engine) 10,000 ft. (3,050 m.).
Take-off run (sea level I.C.A.N. conditions) 466 yds. (373 m.).
Take-off to 50 ft. (15.2 m.) 800 yds. (695 m.).
Take-off to 50 ft. (15.2 m.) (one engine) 1,140 yds. (1,005 m.).
Landing run (sea level I.C.A.N. conditions) 440 yds. (329 m.).
Still air range at weak mixture cruising at 5,000 ft. (1,525 m.) with 173 Imp. gallons (785 litres) fuel 894 miles (1,440 km.) at 151 m.p.h. (243 km.h.) 818 miles (1,315 km.) at 165 m.p.h. (266 km.h.) and 740 miles (1,190 km.) at 178 m.p.h. (286 km.h.).
Still air range at weak mixture cruising at 5,000 ft. (1,525 m.) with 106 Imp. gallons



The Percival P.54 Prince IIIA Air Survey Monoplane (two 550 h.p. Alvis Leonides engines).



The Percival Sea Prince C. Mk. 2 Naval Communications monoplane (two Alvis Leonides engines).

(482 litres) fuel 550 miles (885 km.) at 151 m.p.h. (243 km.h.), 501 miles (806 km.) at 165 m.p.h. (266 km.h.) and 453 miles (729 km.) at 178 m.p.h. (286 km.h.).

Still air range at weak mixture cruising at 10,000 ft. (3,050 m.) with 173 Imp. gallons (785 litres) fuel 902 miles (1,450 km.) at 159 m.p.h. (256 km.h.) 853 miles (1,370 km.) at 178 m.p.h. (286 km.h.) and 752 miles (1,210 km.) at 190 m.p.h. (306 km.h.).

Still air range at weak mixture cruising at 10,000 ft. (3,050 m.) with 106 Imp. gallons (482 litres) fuel 552 miles (888 km.) at 159 m.p.h. (256 km.h.), 520 miles (837 km.) at 178 m.p.h. (286 km.h.) and 461 miles (742 km.) at 190 m.p.h. (306 km.h.).

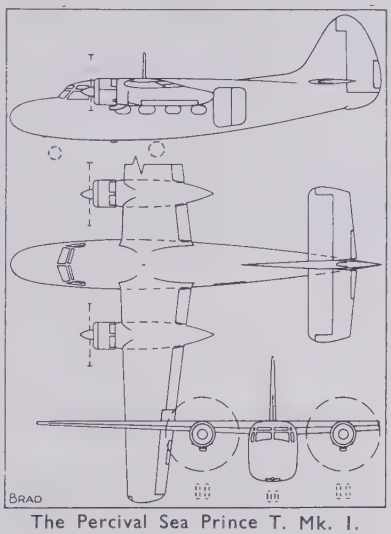
THE PERCIVAL P.54 SURVEY PRINCE III A.

This version of the Prince has been developed for aerial survey work. In general it is similar to the standard Prince III, the major alteration being the extended nose containing an observer photographer's position, which gives a wide unobstructed view ahead from well above the horizon to a point 10 degrees aft of the vertical below the aircraft.

The floor of the main cabin has been modified to incorporate two camera hatches, each 23 in. × 21 in. (58.5 cm. × 53.4 cm.). There are also two circular ports in place of the fourth cabin side windows, through which cameras can be used in conjunction with the aft vertical camera for horizon-to-horizon tri-metrogon photography. Design of the camera positions is such as to allow for the use of most current air survey cameras.

The Survey Prince is equipped with Smith's S.E.P.1 Electronic Auto pilot and oxygen and heating for all crew members.

The tank capacity is 226 Imp. gal.



The Percival Sea Prince T. Mk. 1.

(1,027 litres), giving an endurance of 6 hours and a still air range (with no allowances) of 1,000 miles (1,600 km.) when cruising at a true speed of 172 m.p.h. (275 km.h.) at 10,000 ft. (3,050 m.).

The Survey Prince is also readily convertible for the carriage of 8 to 10 passengers or freight. Fixed fittings may be supplied to enable the aircraft to be used as an ambulance to carry six stretcher cases plus attendants.

WEIGHTS.—
Bare weight 7,436 lb. (3,373 kg.).
Fixed equipment 509 lb. (230 kg.).
Removable equipment 455 lb. (207 kg.).
Tare weight 8,400 lb. (3.810 kg.).
Disposable load 2,600 lb. (1,179 kg.).
All-up weight 11,000 lb. (4,989 kg.).

PERFORMANCE.—
Same as for Prince III.

THE PERCIVAL SEA PRINCE.

Developed from the Civil Prince, the following versions of the Sea Prince are in service in, or in production for, the Royal Navy.

Sea Prince C. Mk. 1. Communications aircraft similar to the civil Prince Series II but carrying extra equipment. One used by Flag Officer (Air) Home and another by the naval staff with the British Joint Services Mission in Washington, D.C., U.S.A.

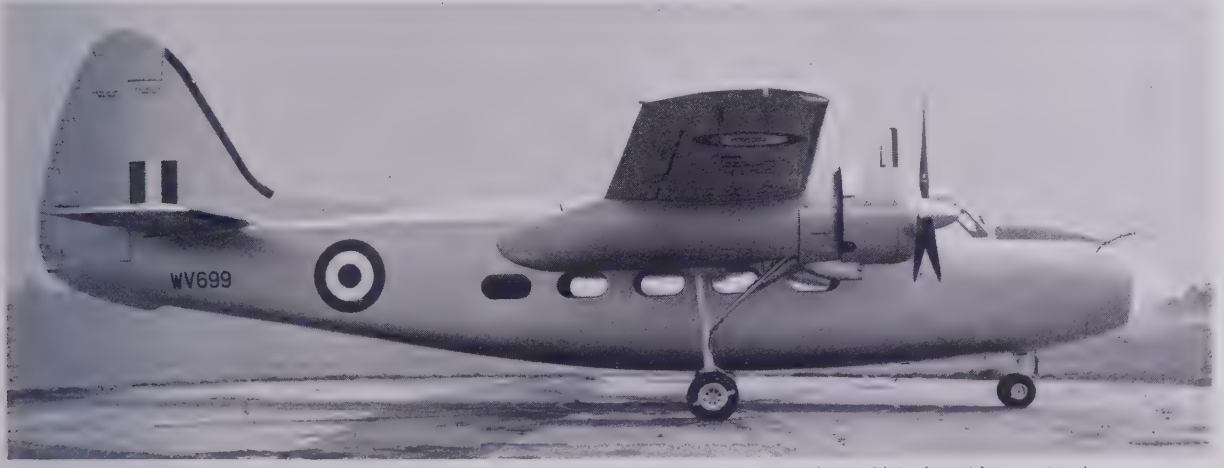
Sea Prince C. Mk. 2. Improved version with increased disposable load. Accommodates crew of two and eight passengers in rearward-facing seats. Strengthened landing-gear with dual main wheels. Length : 46 ft. (14.0 m.). All-up weight 11,850 lb. (5,380 kg.).

Sea Prince T. Mk. 1. Training aircraft for instruction in navigation and anti-submarine warfare. Carries extensive radio and radar equipment. Landing-gear modified and fitted with dual main wheels. Lengthened nose. All-up weight 11,850 lb. (5,380 kg.).

THE PERCIVAL PEMBROKE.

The Pembroke C. Mk. 1 is an eight-seat communications version of the Prince with increased disposable load and all-up weight which is in production for the Royal Air Force. It is also adaptable for freighting, long-range ferrying and casualty evacuation.

Fixed fittings in the cabin are provided for eight 15G rearward-facing seats, for stretchers or for lashing down cargo.



The Percival Pembroke C. Mk. 1 Military Communications monoplane (two Alvis Leonides engines).

The main cabin door is removable for parachuting freight and equipment.

De-icing equipment, reversible-pitch airscrews and dual-wheel landing are fitted. A fixed supply of oxygen is provided for the crew with portable oxygen equipment for the passengers.

The Pembroke ordered by the Belgian Air Force incorporates a number of modifications as compared with the R.A.F. Pembroke C. Mk. 1. The principal modification consists of fitting a clear-view photographic sighting nose, together with an optically flat window in the nose compartment and vertical and oblique camera apertures in the main cabin, for air survey and photography.

There is a separate crew compartment in the passenger-carrying version with accommodation for pilot, co-pilot, radio operator and navigator. Removable dual controls are fitted which may also be used for twin-engine pilot training, with two-stage amber screening for cloud or night flying training.

DIMENSIONS.—
Span 64 ft. 6 in. (19.6 m.).
Length 46 ft. 0 in. (14.0 m.).
Height 16 ft. 1 in. (4.9 m.).

WEIGHTS (Communications version).—
Weight empty (equipped) 8,993 lb. (4,073 kg.).
Fuel and oil 2,299 lb. (1,044 kg.).
Useful load 1,440 lb. (654 kg.).
Baggage, etc. 268 lb. (122 kg.).
Weight loaded 13,000 lb. (5,903 kg.).

PERFORMANCE.—
Max. rich mixture cruising speed 209 m.p.h. (337 km.h.) at 5,000 ft. (1,525 m.).
Max. weak mixture cruising speed 185 m.p.h. (302 km.h.) at 10,000 ft. (3,050 m.).
Most economic cruising speed 150 m.p.h. (223 km.h.) at 8,000 ft. (2,440 m.).
Initial rate of climb 1,500 ft./min. (7.62 m./sec.).
Climb to 6,000 ft. (1,830 m.) 5.6 min.
Climb to 10,000 ft. (3,050 m.) 10.5 min.
Climb to 20,000 ft. (6,100 m.) 34.4 min.).
Service ceiling 22,000 ft. (6,070 m.).
Range 575 miles (920 km.) at 172 m.p.h. (275 km.h.) at 8,000 ft. (2,440 m.).

SARO



The Saro Princess Transport Flying boat (ten Bristol Proteus 600 Series turboprop engines).

SAUNDERS-ROE, LTD.

HEAD OFFICE: OSBORNE, EAST COWES, ISLE OF WIGHT.

WORKS: EAST COWES, ISLE OF WIGHT, AND AT SOUTHAMPTON AIRPORT, EASTLEIGH, HANTS.

HELICOPTER DIVISION: SOUTHAMPTON AIRPORT, EASTLEIGH, HANTS.

President: Sir Alliott Verdon-Roe, O.B.E., Hon. F.R.Ae.S., M.I.Ae.E.

Directors: Hon. H. N. Morgan-Grenville, O.B.E. (Chairman), Sir Arthur Gouge, B.S., F.R.Ae.S., M.I.Mech.E. (Vice-Chairman), Captain E. D. Clarke, M.C. (Managing Director), W. Browning, F.R.Ae.S., A.M.I.Mech.E., M.I.P.E. (General Manager), H. Knowler, A.M.I.C.E., F.R.Ae.S. (Technical), R. V. Perfect (Sales and Publicity), The Hon. M. F. P. Lubbock, M. D. N. Wyatt and P. D. Irons, B.Com., A.C.A., F.C.W.A. (Secretary).

Saunders-Roe have specialised in the design and construction of flying-boats over many years. They are continuing this development using turbojet and turboprop engines.

The Saunders-Roe Helicopter Division was formed on January 22, 1951, when the company took over the premises, current design commitments and technical staff of the Cierva Autogiro Co., Ltd.

THE SARO SR.45 PRINCESS.

Design of the Princess began originally in 1943, as an extension of the company's ideas for a large long-range commercial flying-boat.

In July, 1945, the company was invited by the Ministry of Supply to tender for the construction of an aircraft of this type, and in May, 1946, the building of three examples was authorised. At that time B.O.A.C. had signified their interest in the project, envisaging its use on the direct London New York route.

Early in 1951, B.O.A.C., by then fully committed to landplane operations, decided not to operate the Princess. Thereupon it was officially announced that the three Princesses being built would be completed for the R.A.F. as long-range military transports.

In March, 1952, a further official pronouncement declared that the first Princess, powered by ten Proteus 600 Series engines, would be completed, but that work on the second and third boats would be temporarily stopped to await production of the more powerful Proteus 700 Series engines for which the Princess was designed, and to release capacity for more urgently-needed construction.

TYPE.—Long-range Transport Flying-boat.

WINGS.—High-wing cantilever monoplane. Aspect ratio 9.5. All-metal two-spar structure in five main units; centre wing, two inner wings, and two outer wings. Centre wing, span 27 ft. (8.22 m.), chord 30 ft. 9 in. (9.36 m.), integral with hull. Inner wings each of 40 ft. 3 in. (12.95 m.) span, tapering in chord from 30 ft. (9.15 m.) to 26 ft. (7.92 m.). Outer wings each of 51 ft. 6 in. (15.70 m.) span with tip chord of 11 ft. (3.35 m.). Wing thickness at root 5.4 ft. (1.65 m.), at tip 1.3 ft. (0.39 m.). Electrically-operated slotted flaps on centre and inner wings. Electra-hydraulic mechanical power-controlled four-piece ailerons in each outer wing. Thermal anti-icing, with heated air taken from heat-exchangers on tailpipes of outer engines. Gross wing area 5,250 sq. ft. (490.0 m.²).



The Saro Princess Transport Flying boat. The ten Bristol Proteus engines are in four coupled pairs and two single units.

HULL.—Two-step metal structure. "Double-bubble" arrangement providing two main decks. Hull is pressurised from forward of flight deck to tail breakdown joint aft; pressure differential 8 lb./sq. in. (56.2 kg./m.²). Pressurisation by two compressors in wing roots and driven by inboard engines. Height of hull 24 ft. 3 in. (7.39 m.), beam 16 ft. 8 in. (5.08 m.), draught 8 ft. (2.44 m.). Retractable wing-tip floats.

TAIL UNIT.—Cantilever monoplane type. Dihedral tailplane. Electro-hydraulic mechanical power-controlled rudder in three sections and elevators in two sections each. Tail-unit thermal anti-icing by self-contained kerosene combustion heaters with independent fuel supply and electric ignition from cockpit. Tailplane span: 77 ft. (23.48 m.). Tailplane chord 22 ft. (6.71 m.) at root, 6 ft. 9 in. (2.06 m.) at tip. Tailplane area: about 1,000 sq. ft. (92.9 m.²). Fin and rudder area about 600 sq. ft. (55.7 m.²).

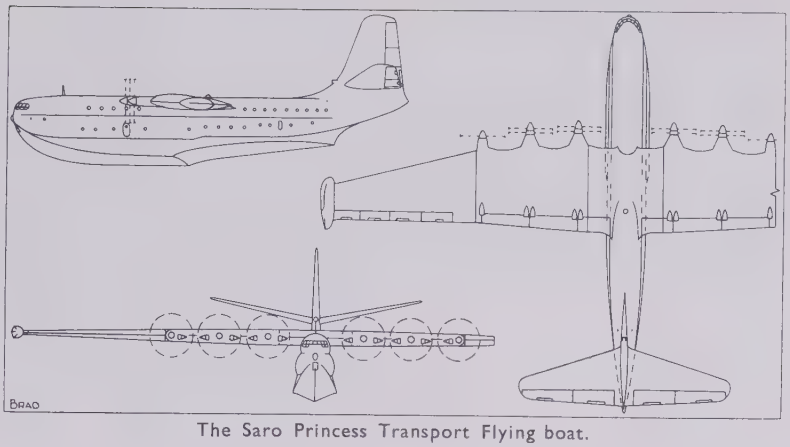
POWER PLANT.—Ten Bristol Proteus 600 Series turboprop engines in four coupled pairs and two single units. Each inner wing carries two paired units inboard and one single unit outboard; engine jet pipes pass through wing main spars to exhaust in trailing edge above flaps. Fuel is carried in two integral tanks in each inner wing between engine bays. Total capacity 14,500 Imp. gallons (65,250 litres).

ACCOMMODATION.—No information yet available.

DIMENSIONS.—
Span (wing tip-floats down) 210 ft. 6 in. (64.2 m.).
Span (wing-tip floats up) 219 ft. 6 in. (67.0 m.).
Length 148 ft. 0 in. (45.3 m.).
Height 55 ft. 9 in. (17.0 m.).

WEIGHTS (Designed).—
Weight empty (fully equipped) 190,000 lb. (86,260 kg.).
Payload 40,000 lb. (18,160 kg.).
Weight loaded 315,000 lb. (143,000 kg.).

PERFORMANCE (Estimated).—
Cruising speed 380 m.p.h. (608 km.h.).
Still air range 5,500 miles (8,850 m.).



The Saro Princess Transport Flying boat.

THE SARO SKEETER.

The Skeeter was developed by the Cierva company after the war as a small two-seat helicopter for the private owner. The first prototype, powered with a 106 h.p. Jameson engine, flew for the first time on October 8, 1948.

A slightly larger Mk. 2 version, with a 145 h.p. D.H. Gipsy-Major 10 engine mounted athwartships behind the cabin, flew on October 20, 1949.

Mk. 3 and 4 versions, for military and naval use respectively, had been developed when Saro took over the Cierva company. Saro actually took over two Mk. 3's and one Mk. 4, and all three aircraft have since been subjected to an extensive test programme under a Ministry of Supply contract.

The two Mk. 3's, were originally powered with the 145 h.p. D.H. Gipsy Major engine but they have since been re-engined with the 180 h.p. Cirrus Bombardier engine, with which the Mk. 4 is also powered.

TYPE.—Two-seat light helicopter.

ROTORS.—One three-blade main rotor of composite construction, with steel spar tube, wood leading-edge and ribs and fabric covering. Diameter 29 ft. 5 in. (9 m.), chord (constant) 10 in. (25.3 cm.). One all-metal three-blade vertical controllable-pitch anti-torque and steering rotor, diameter 5 ft. (1.53 m.). Transmission for main rotor through spur reduction gear to intermediate shaft driving final bevel. Tail rotor driven off same intermediate shaft through free-wheel and manually-operated clutch.

FUSELAGE.—All-metal structure. Cabin of fabricated sheet construction with Perspex canopy. Centre section of welded steel tubes carries main rotor pylon. Tail boom is a tapered monocoque.

LANDING GEAR.—Tricycle nose-wheel type.

POWER PLANT.—One 180 h.p. Cirrus Bombardier four-cylinder inverted air-cooled engine mounted athwartships immediately aft of the cabin fireproof bulkhead. Fuel is carried in rear of the cabin, forward of the bulkhead.

ACCOMMODATION.—Two side-by-side in cabin, with 360 degree vision. Entrance door on each side.

CONTROLS.—Dual control; full cyclic control through swashplate; coupled throttle and pitch control; foot pedals control pitch of tail rotor.

DIMENSIONS.—
Main rotor diameter 32 ft. (9.75 m.).
Tail rotor diameter 5 ft. 8 in. (1.63 m.).
Overall length 38 ft. 4½ in. (11.7 m.).
Overall length (folded) 28 ft. 5 in. (8.67 m.).
Overall height 10 ft. (3.05 m.).

WEIGHTS.—
Weight empty 1,476 lb. (670 kg.).
Max. load 624 lb. (283 kg.).
Max. loaded weight 2,100 lb. (953 kg.).

PERFORMANCE (ICAN conditions—estimated).—
Max. speed at S/L. 115 m.p.h. (185 km.h.).
Max. rate of climb at S/L. 1,250 ft./min. (384 m./min.) at 50 m.p.h. (80 km.h.).
Operational ceiling 13,000 ft. (3,960 m.).
Absolute ceiling 15,500 ft. (4,720 m.).
Hovering ceiling 3,300 ft. (1,006 m.).
Endurance at 86 m.p.h. (138 km.h.) 3 hours.
Endurance at 86 m.p.h. (138 km.h.) with long-range tank 4.5 hours.



The Saro Skeeter Mk. 4 Helicopter (180 h.p. Cirrus Bombardier engine).

SCOTTISH AVIATION

SCOTTISH AVIATION, LTD.

HEAD OFFICE AND WORKS: PRESTWICK AIRPORT, AYRSHIRE.

LONDON OFFICE: 25, COCKSPUR ST., S.W.1.

Directors: The Duke of Hamilton, P.C., G.C.V.O., A.F.C., F.R.G.S. (Chairman), Group Captain D. F. McIntyre, A.F.C. (Managing Director), F. W. Hopkins, A.F.R.Ae.S. and T. D. M. Robertson (General Manager).

Chief Designer: R. McIntyre, A.F.R.Ae.S.

Scottish Aviation Ltd. was formed in 1935 with the object of developing aviation services, and operating flying schools and airports in Scotland. In addition, the Company developed a factory organization, specialising in repair and overhaul of aircraft.

Since the War, the first aircraft of original Scottish design and manufacture has been built. This started life as a light military communications aircraft to Specification A.4/45. The original military requirement not having materialised, the basic design was developed into a light transport as the Prestwick Pioneer.

A small number of Pioneers has been acquired by the Royal Air Force for service in Malaya.

THE PRESTWICK PIONEER II.

TYPE.—Five-seat light Transport, designed for operation from restricted landing fields.

WINGS.—High-wing strut-braced monoplane. Constant chord wing of NACA 4415 section fitted with hydraulically-operated full-span slats and 57.5% span Fowler and split flaps. For take-off, leading-edge slat is open and Fowler flap setting 20°. For landing, the Fowler flap lowers to 30°. The dihedral angle is 1° and incidence 4°. Wing of all-metal, two-spar stressed-skin construction. Wings braced to fuselage by single strut on each side. Fowler flap and slat run in tracks of extruded I-section light alloy and are operated by a system of cables from single jack located in port wing. Ailerons are of metal construction with fabric covering. Flaps and slats are interchangeable port and starboard. Fowler flap area 67.2 sq. ft. (6.25 m.²). Gross wing area 390 sq. ft. (36.2 m.²).

FUSELAGE.—Alclad stressed-skin construction of basically oval cross-section.

TAIL UNIT.—Cantilever monoplane type. Construction of tailplane and fin is similar to that of wing. Rudder and elevators are metal with fabric covering, port and starboard elevators being interchangeable. The tailplane is electrically actuated, its incidence being adjustable in flight over a range from +4° to —5°.

LANDING GEAR.—Fixed tail-wheel type. Oleo-pneumatic shock-absorber struts. Hydraulic wheel-brakes. Track 9 ft. 8 in. (2.95 m.).

POWER PLANT.—One 540 h.p. Alvis Leonides 14 (501/4) radial air-cooled engine, supplied

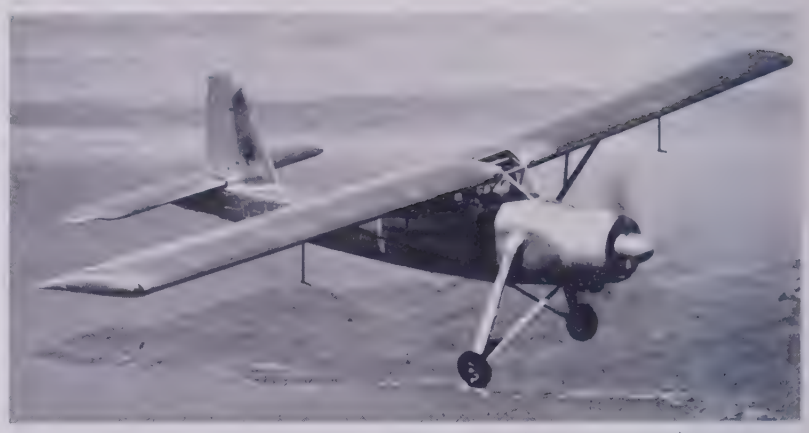
as a complete power-plant unit. Rotol or D.H. three-blade constant-speed airscrew. Later aircraft will have the 570 h.p. Leonides 502/4 engine.

ACCOMMODATION.—Enclosed cabin seating five in a one-two-two arrangement with the pilot's seat forward on the centre line. The back of the pilot's seat hinges rearwards to facilitate entry and exit. Seats and harness stressed to withstand a deceleration of 25g. All seats are readily removable and the cabin can be arranged to carry one stretcher and attendant.

DIMENSIONS.—
Span 52 ft. 6 in. (16 m.).
Length 34 ft. 7 in. (10.53 m.).
Height (thrust line horizontal) 13 ft. 5 in. (4.09 m.).

WEIGHTS AND LOADINGS.
Weight empty 3,826 lb. (1,735 kg.).
Disposable load 1,404 lb. (637 kg.).
Weight loaded 5,400 lb. (2,450 kg.).
Wing loading at take-off 13.15 lb./sq ft. (64 kg./m.²).
Power loading at take-off 10.38 lb./h.p. (4.7 kg./h.p.).

PERFORMANCE (Leonides 501/4 engine).
Max. speed at 4,250 ft. (1,295 m.) 162 m.p.h. (261 km.h.).
Max. cruising speed at 9,750 ft. (2,970 m.) 151 m.p.h. (342 km.h.).
Max. cruising speed, weak mixture at 11,750 ft. (3,580 m.) 141 m.p.h. (227 km.h.).
Range at 120 m.p.h. at 5,000 ft. (1,525 m.) 400 miles (645 km.).
Take-off distance to 50 ft. (15.2 m.) 230 yds. (210 m.).
Landing distance from 50 ft. (15.2 m.) 200 yds. (182 m.).
Stalling speed with flaps down, engine off 38 m.p.h. (61.5 km.h.).



The Prestwick Pioneer II (540 h.p. Alvis Leonides engine).

SHORT

SHORT BROTHERS & HARLAND, LTD.

HEAD OFFICE AND WORKS: QUEEN'S ISLAND, BELFAST, N. IRELAND.

LONDON OFFICE: 17, GROSVENOR STREET, W.1.

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Secretary: E. W. A. Woolmer, B.A., C.A.

The firm of Short Brothers, which is the oldest established firm of aircraft designers and producers in the United Kingdom, was founded by the brothers Eustace and Oswald Short in 1898 their work for some years being the manufacture of spherical balloons.

After the first World War, during which various types of naval aircraft were produced, the company pioneered in metal construction and concentrated on the development of the all-metal flying-boat, and many notable designs of both military and civil flying-boats have been built, all of which have been fully illustrated and described in previous editions of "All the World's Aircraft."

In June, 1936, Short Brothers, in collaboration with Harland & Wolff, Ltd. the well-known shipbuilders, formed a new company known as Short & Harland, Ltd. to build aircraft in Belfast.

In September, 1947, as a result of Government policy, the company's works at Rochester were closed and all the activities were concentrated at Belfast. Consequently the Rochester company, Short Brothers (Rochester & Bedford) Ltd., and the Belfast company were merged to form Short Brothers and Harland Ltd. of Belfast.

Current Short designs include S.B.5 research monoplane which first flew on December 2, 1952, the S.A.4 four-jet bomber, two prototypes of which are flying, the Sealand light twin-engined amphibian. In 1953 ten Sealands were supplied to the Indian Navy. These aircraft are being used for communications and for training gunners and radio operators in fleet liaison.

The Sunderland four-engined oversea reconnaissance flying-boat, which went out of production in 1945, is still in service in the Royal Air Force. A large number of reconditioned R.A.F. Sunderlands have, in recent years been supplied to the French Navy for service in West Africa, and in 1953 sixteen reconditioned Sunderlands were delivered to the Royal New Zealand Air Force. The New Zealand Sunderlands are standard Mk. 5's with the addition of specially sensitive long-range radio and radar equipment for accurate navigation and for maximum search and strike efficiency over Southern Pacific waters.

Short and Harland are building the English Electric Canberra jet bomber under direct contract from the Ministry of Supply. The first Short-built Canberra flew for the first time on October 30, 1952.

In 1952, by arrangement with the de Havilland Aircraft Co., Ltd. Short & Harland undertook to manufacture the Comet airliner. The first Short-built Comet Series 2 is expected to fly in 1954.

THE SHORT S.B.5.

The S.B.5 is a research aircraft which was designed and built at the request of the Ministry of Supply for the investigation of problems associated with the low-speed handling characteristics of swept-back wings.

The S.B.5 was designed so that varying degrees of sweepback can be tested. The tailplane can also be positioned either at the extreme top of the fin or beneath the rear fuselage and its angle of incidence is variable.

The varying degrees of sweep-back angle are achieved by fitting alternative components and four configurations can be tested. These are 50° wing sweepback with high tail-unit; 60° sweepback with



The Short S.B.5 Research Monoplane (Rolls-Royce Derwent turbojet engine).

low tail-unit; 60° sweepback with high tail-unit; and 69° sweepback with high tail-unit. The angle of incidence of the tailplane can be varied in flight from 10° above to 10° below the horizontal. The position of the non-retracting nose-wheel landing-gear can be changed to enable each configuration to be tested at various C.G. positions.

The S.B.5 is powered by a Rolls-Royce Derwent turbojet engine. It is mainly of all-metal construction, the leading and trailing-edges of the wings being plywood-covered. The pilot's cockpit which is forward of the wings, is provided with an ejector seat. Anti-spin and braking parachutes are fitted.

DIMENSIONS.—
Span (50° configuration) 35 ft. 2¼ in. (10.74 m.).
Span (60° configuration) 30 ft. 6 in. (9.30 m.).
Span (69° configuration) 25 ft. 11¾ in. (7.92 m.).
Overall length 47 ft. 4 in. (14.43 m.).
Max. Height (high tailplane) 16 ft. 7 in. (5.0 m.).

THE SHORT S.A.4.

The S.A.4 was designed and built to a specification drawn up by the Ministry of Supply shortly after the end of the war for a multi-jet long-range bomber. It is powered by four Rolls-Royce Avon turbojet engines arranged in vertical pairs in wing-mounted nacelles.

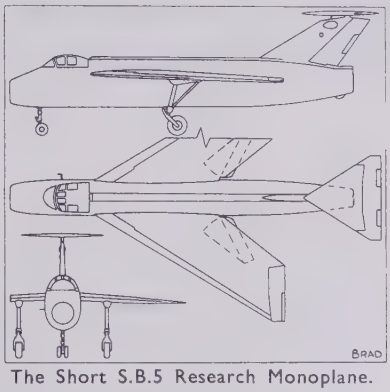
Although the S.A.4 is unlikely to go into production it does incorporate several important developments and advanced ideas, particularly in construction and in connection with flying controls, and is fully capable of carrying the large loads demanded by modern operational requirements. Its usefulness is therefore likely to be in the research field, where a large high-speed weight-carrying aircraft is needed for the investigation of the many problems associated with all aspects of modern bomber design, equipment and operation.

The S.A.4/1 first prototype flew for the first time on August 10, 1951, and the S.A.4/2 second and more highly-powered prototype made its maiden flight on August 12, 1952. Both aircraft are engaged in a programme of special trials for the testing and development of special equipment. No details of structure, equipment or performance may yet be published.

DIMENSIONS.—
Span 109 ft. (33.24 m.).
Length 102 ft. (31.11 m.).
Height 28 ft. 6 in. (8.69 m.).



The Short S.B.5 Research Monoplane (Rolls-Royce Derwent engine).



The Short S.B.5 Research Monoplane.

THE SHORT S.A.2 STURGEON.

TYPE.—Twin-engined two-seat Naval Target-tug.

WINGS.—Cantilever mid-wing monoplane. Aerofoil section NACA 642(25)15.3 at root, NACA 642(25)15.6 at tip. Aspect ratio 6.4. Incidence 2°. Dihedral (outer wings) 3¾°. All-metal two-spar structure. Outer wing sections fold rearwards hydraulically about rear spar to lie alongside fuselage. with leading-edges downwards. All-metal Frise-type ailerons with inset trim-tab and spring servo-tab in each. Aileron area (each—aft of hinge) 33.56 sq. ft. (3.12 m.²). Zapp area-increasing flaps on centre-section and outer wings between ailerons and fuselage. Hydraulic operation. Flap area (total) 86.4 sq. ft. (8.03 m.²). Gross wing area 560.4 sq. ft. (52 m.²).

FUSELAGE.—All-metal monocoque structure. Nose of fuselage folds down for carrier stowage.

TAIL UNIT.—Cantilever monoplane type. Fin and tailplane are metal structures with riveted metal skin. Elevators and rudder have metal frames and are fabric-covered. Combined servo/trim-tab in each elevator and in rudder. Tailplane span 20 ft. 0 in. (6.1 m.). Gross tailplane and elevator area 108.22 sq. ft. (10 m.²); elevator area (each) 27.37 sq. ft. (2.54 m.²). Gross fin and rudder area 72.7 sq. ft. (6.75 m.²); rudder area 16.6 sq. ft. (1.54 m.²).

LANDING GEAR.—Retractable tail-wheel type. Messier oleo-pneumatic shock-absorber struts. Electro-hydraulic retraction with emergency pneumatic gear. Track 14 ft. 3 in. (4.34 m.). Pneumatic brakes. Retractable R.A.F. A-frame arrester hook under rear fuselage.

POWER PLANT.—Two 1,660 h.p. Rolls-Royce Merlin 140 twelve-cylinder vee liquid-cooled engines. Rotol or D.H. three-blade contra-rotating airscrews 10 ft. 0 in. (3.05 m.) diameter. Marston flexible crash-proof fuel tanks with total capacity of 430 Imp. gallons (1,956 litres) in centre-section. Auxiliary 60 Imp. gallon (273 litre) ferrying tank can be installed in fuselage. One 22 Imp. gallon (100 litre) oil tank in each engine nacelle.

ACCOMMODATION.—Crew of two. Pilot's cockpit in-line with leading-edge of wing. Camera position in nose extension with optically-flat panels in front and on starboard side for photographing "throw-off" gunfire. Navigator/winch-operator's position aft of wings with target winch and stowage, dorsal camera and radar equipment. When winch is not fitted there is a communicating passage to nose for navigator to go forward to operate camera.

EQUIPMENT.—Camera in transparent nose compartment for "throw-off" gunfire marking. Miles hydraulic target winch in lower fuselage aft of trailing-edge of wing and dorsal camera position in break in fuselage top-line for target marking. Radio/radar equipment. One M-type and two K-type dinghies. Oxygen for both crew members for 2 hours at 30,000 ft. (9,150 m.).

DIMENSIONS.—
Span 59 ft. 9 in. (18.22 m.).
Width folded 22 ft. 5 in. (6.85 m.).
Length overall 48 ft. 11 in. (14.91 m.).
Length with nose folded 45 ft. 9½ in. (13.95 m.).
Height 13 ft. 2½ in. (4.02 m.).
Height folded 15 ft. 4 in. (4.68 m.).

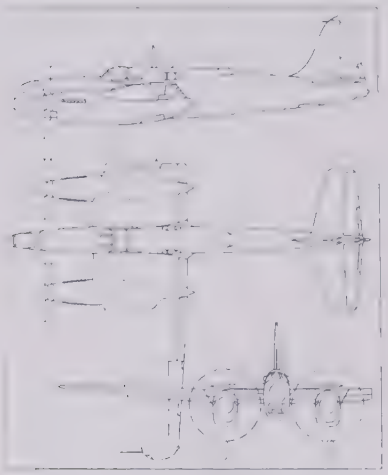
WEIGHTS AND LOADINGS.—
Tare weight 17,647 lb. (8,050 kg.).
Fuel and oil 3,033 lb. (1,338 kg.).



The Short S.A.4/2 Experimental Long-Range Bomber (four Rolls-Royce Avon turbojet engines).



The Short Sturgeon T.T. Mk. 2 Naval Target-tug showing the nose folded down for carrier stowage.



The Short Sturgeon T.T. Mk. 2.

Crew of two, parachutes and K-type dinghy each 446 lb. (202.5 kg.).
Service load 974 lb. (443 kg.).
Weight loaded 22,100 lb. (1,015 kg.).
Power loading 6.5 lb./h.p. (2.95 kg./h.p.).

PERFORMANCE (at 21,000 lb.=9,534 kg.).—
Max. emergency cruising speed of aircraft alone 356 m.p.h. (570 km.h.) at 24,200 ft. (7,380 m.).
Continuous cruising speed at 15,000 ft. (4,575 m.) of aircraft alone 302 m.p.h. (483 km.h.).
Of aircraft towing a 32 ft. (9.76 m.) winged target 248 m.p.h. (397 km.h.).
Of aircraft towing a 4 ft. (1.22 m.) low-drag sleeve target 262 m.p.h. (419 km.h.).
Landing speed 95 m.p.h. (152 km.h.).
Rate of climb at sea level of aircraft alone 2,030 ft./min. (620 m./min.).
Of aircraft towing a 32 ft. (9.76 m.) winged target 1,780 ft./min. (543 m./min.).
Service ceiling of aircraft alone 34,700 ft. (10,585 m.).
Of aircraft towing a 32 ft. (9.76 m.) winged target 32,900 ft. (10,035 m.).
Endurance (including one hour towing a 32 ft. (9.76 m.) winged target) at 290 m.p.h. (464 km.h.) at 15,000 ft. (4,575 m.) 3.25 hours.
Take-off run in 31 m.p.h. (50 km.h.) wind 105 yds. (96 m.).

THE SHORT S.A.6 SEALAND.

In addition to the standard Mk. 1 amphibian version described below, the Sealand is available as a flying-boat, with no provision for landing-gear. This version, the Sealand 3, has provision for 10 passengers when no toilet compartment is fitted. Performance is slightly better than that of the amphibian.

TYPE.—Twin-engined Light Commercial Amphibian Flying-boat.

WINGS.—High-wing cantilever monoplane. Wing section Goettingen 436 modified. Aspect ratio 10.54. Incidence 6°. Dihedral 2° 16′. Taper ratio 3.67. All-metal structure with Alclad stressed-skin covering flush riveted over leading-edge only. Pneumatically-operated metal-framed fabric-covered flaps from hull to ailerons, area 65 sq. ft. (6.05 m.²). Metal-framed fabric-covered aerodynamically-balanced ailerons, area 19.4 sq. ft. (1.81 m.²). Gross wing area 358.6 sq. ft. (33.35 m.²).

HULL AND FLOATS.—Two-step all-metal structure with Alclad stressed skin, flush-riveted on planing bottom only. Interchangeable welded Birmabright wing-tip floats on cantilever struts.

TAIL UNIT.—Cantilever monoplane type. Two-spar all-metal tail plane and fin. Aerodynamically-balanced elevators and rudder. Trim tabs in elevators and rudder. Tailplane area 68.11 sq. ft. (6.33 m.²). Fin and rudder area 45.16 sq. ft. (4.19 m.²).

LANDING GEAR.—Retractable type by Electro-Hydraulics Ltd. Each unit consists of two nearly horizontal link struts hinged at their inner ends to the hull and at their outer ends to a vertical oleo leg. Pneumatic jack situated diagonally between the link struts deforms the parallelogram formed by the struts and upper portion of the oleo leg to raise the strut and wheel vertically into a recess in the side of the hull. Tail-wheel is turned through 180° about its horizontal shock strut to lie behind the rear step above the water-line when retracted. Wheel track 10 ft. (3.05 m.).

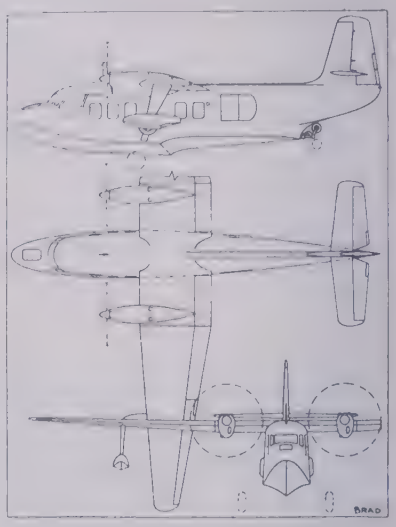
POWER PLANT.—Two 340 h.p. D.H. Gipsy Queen 70-4 six-cylinder in-line inverted air-cooled geared and supercharged engines driving D.H. constant-speed feathering and reversing airscrews 7 ft. 6 in. (2.29 m.) diameter. Two welded aluminium fuel tanks in centre-section, one on each side of the hull. Total capacity 119 Imp. gallons (541 litres). Additional fuel tankage is available, amounting to 25 Imp. gallons (113.5 litres) in wing centre-section tanks and a further 40 Imp. gallons (181.6 litres) in outer wing leading-edge tanks. Oil tanks behind engines.

ACCOMMODATION.—Pilot's compartment seats pilot on port side with single controls. A dual-control installation can be provided which is readily removable. Provision for radio-operator on starboard side. Curved Perspex windscreen with hot-air de-misting, glycol spray and mechanical wiper. Sliding side windows. Mooring hatch and external step. Accommodation for from five to eight passengers in two compartments joined by passage between wheel wells. Entrance hatch, baggage space and toilet (in five-seat version) aft. Large side windows with the rear window on each side of the front compartment of push-out type for emergency exit. Controlled heating and ventilation and soundproofing.

DIMENSIONS.—
Span 61 ft. 6 in. (18.75 m.).
Length 42 ft. 2 in. (12.84 m.).
Height (keel to top of rudder) 15 ft. 6 in. (4.72 m.).

WEIGHTS.—
Weight empty 7,065 lb. (3,205 kg.).
Gross weight 9,100 lb. (4,130 kg.).
Wing loading 25.4 lb./sq. ft. (124 kg./m.²).

PERFORMANCE (at 9,100 lb.=4,130 kg.).—
Max. speed 185 m.p.h. (298 km.h.) at 5,000 ft. (1,520 m.).
Cruising speed 176 m.p.h. (283 km.h.) at 8,000 ft. (2,440 m.).
Landing speed 77 m.p.h. (124 km.h.) on land.
Alighting speed 81 m.p.h. (131 km.h.) on water.
Initial rate of climb 1,000 ft./min. (305 m./min.).
Climb at 10,000 ft. (3,050 m.) 730 ft./min. (223 m./min.).
Service ceiling 20,800 ft. (6,340 m.).
Range with 5 passengers and baggage and 105 Imp. gallons (478 litres) fuel, 471 miles (758 km.) at 161 m.p.h. (259 km.h.) and 595 miles (956 km.) at 127 m.p.h. (204 km.h.).



The Short Sealand Amphibian.



The Short Sealand Amphibian Flying-boat.

SLINGSBY

SLINGSBY SAILPLANES, LTD.

HEAD OFFICE AND WORKS: KIRBYMOORSIDE, YORKSHIRE.

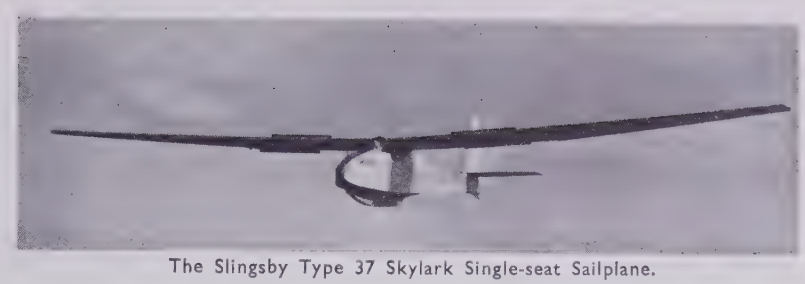
Directors: F. N. Slingsby, M.M., A.F.R.Ae.S. (Managing), Major J. E. D. Shaw, Lieut.-Col. G. R. D. Shaw, J. R. Archer, G. E. Shaw, G. Dixon.

THE SLINGSBY TYPE 37 SKYLARK.

The Type 37, which is illustrated herewith, was flown for the first time on February 14, 1953. It is the prototype for the Type 40, the production Skylark, which will differ from the Type 37 by having an oval-section fuselage and greater aileron area. The description refers specifically to the Type 37.

TYPE.—Single-seat Sailplane.

WINGS.—High-wing cantilever monoplane. NACA 63_3-618/64_3-618 wing sections. Aspect ratio 17.9. Chord 36 in. (91.5 cm.) at root, 15 in. (38 cm.) at tip. Dihedral 2°. Incidence 5° at root. All-wood monospar structure covered with resin-bonded plywood skin. Unbalanced all-wood ailerons. Dive-brakes. Area of ailerons (total) 12.4 sq. ft. (0.22 m.²). Gross wing area 113 sq. ft. (10.49 m.²).



The Slingsby Type 37 Skylark Single-seat Sailplane.

Single-spar, torsion-resisting nose-box structure with light secondary spar to carry two-piece ailerons. Wood construction. Fabric covered aft of main spar. D.F.S.-type dive brakes. Gross wing area 187 sq. ft. (17.4 m.²). Standard mean chord 3.165 ft. (0.96 m.). Aspect ratio 18.65 : 1.

FUSELAGE.—Ply-covered stressed-skin structure.

TAIL UNIT.—Cantilever tailplane. Fabric covered rudder and elevator. Span 9.9 ft. (3.01 m.).

LANDING GEAR.—Mono-wheel type, with single landing wheel terminating a single centrally-placed ash skid beneath forward fuselage. Alternatively, a jettisonable two-wheel dolly may be used. Ash tail skid.

ACCOMMODATION. — Single-seat cockpit immediately forward of wing leading-edge with one-piece moulded Perspex canopy.

DIMENSIONS.—
Span 59.06 ft. (18 m.).
Length 24.875 ft. (7.585 m.).

WEIGHTS AND LOADINGS.—
Empty weight 549.5 lb. (250 kg.).
Disposable load 250 lb. (113.5 kg.).
All-up weight 800 lb. (364 kg.).
Wing loading 4.29 lb./sq. ft. (21 kg./m.²).

PERFORMANCE.—
Sinking speed at 39 m.p.h. (62.9 km.h.) 2 ft./sec. (0.61 m./sec.).
Gliding angle at 46 m.p.h. (74 km.h.) 1 in 30.



The Slingsby Type 34 Sky Single-seat Sailplane.

FUSELAGE.—Braced wood framework. Covered forward with plywood and aft with fabric.

TAIL UNIT.—Cantilever monoplane type. Tailplane and fin are plywood covered. Tailplane span 9 ft. 6 in. (2.89 m.).

LANDING GEAR.—Fixed rubber-spring central skid. Small tail-skid at base of rudder post.

ACCOMMODATION.—Enclosed cockpit with one-piece Perspex canopy.

DIMENSIONS.—
Span 44 ft. 10½ in. (13.7 m.).
Length 20 ft. 11½ in. (6.4 m.).
Height 5 ft. 2½ in. (1.6 m.).

WEIGHTS.—
Weight empty 380 lb. (172 kg.).
Weight loaded 620 lb. (281 kg.).

PERFORMANCE.—
Best glide ratio 27.3 : 1 at 46.3 m.p.h. (74 km.h.).
Min. sinking speed 2.34 ft./sec. (0.7 m./sec.) at 41.6 m.p.h. (66.5 km.h.).
Stalling speed 37.4 m.p.h. (59.8 km.h.).
Min. speed at max. A.U.W. 39.8 m.p.h. (63.7 km.h.).

THE SLINGSBY TYPE 34 SKY.

The Type 34 high-performance sailplane was specially designed to make an all-British design available for national and international gliding contests.

In the 1952 International Gliding Championships, the British team won first and third places in the single-seat class flying Sky sailplanes. Other nations flying the Sky in that contest were the Argentine Republic and Holland.

TYPE.—High-performance contest sailplane.

WINGS.—High-wing cantilever monoplane.

DIMENSIONS.—
Span 49 ft. 3 in. (15.0 m.).
Length 23 ft. 9½ in. (7.252 m.).
Span of tail 9 ft. 10½ in. (3.012 m.).
Max. chord 3 ft. 11 in. (1.20 m.).
Tip chord 1 ft. 11½ in. (0.60 m.).

WEIGHT EMPTY.—
475 lb. (217 kg.).

PERFORMANCE.—
Gliding angle at 40 m.p.h. (64 km.h.) 1 in 26.
Sinking speed at 38 m.p.h. (60.8 km.h.) 2.3 ft./sec. (0.70 m./sec.).

THE KIRBY CADET.

The Kirby Cadet single-seat glider was designed solely for initial training up to "C" certificate stage. It has been adopted by the Air Ministry for *ab initio* training in the Reserve Training Command and is in extensive use throughout the United Kingdom, over 500 being in service.

It is a high-wing braced monoplane of wood and fabric construction.

DIMENSIONS.—
Span 38 ft. 6 in. (11.73 m.).
Length 20 ft. 10 in. (6.36 m.).
Wing chord 4 ft. 6¾ in. (1.38 m.).
Span of tail 9 ft. 10 in. (3.0 m.).
Wing area 170 sq. ft. (15.8 m.²).

WEIGHTS.—
Weight empty 313 lb. (142 kg.).
Weight loaded 525 lb. (239 kg.).
Wing loading 3.24 lb./sq. ft. (15.8 kg./m.²).

THE KIRBY TUTOR.

The Tutor is a secondary type sailplane which has been evolved from the Cadet by the fitting of a tapered wing of higher aspect ratio and the incorporation of a differential mechanism in the aileron control circuit.



The Slingsby Gull 4 Single-seat High-performance Sailplane.

THE SLINGSBY GULL 4.

The Gull 4 is a high-performance single-seat sailplane, the general arrangement of which can be seen from the photograph which appears above.

DIMENSIONS.—
Span 43 ft. 3¾ in. (13.2 m.).
Other dimensions as for Cadet.

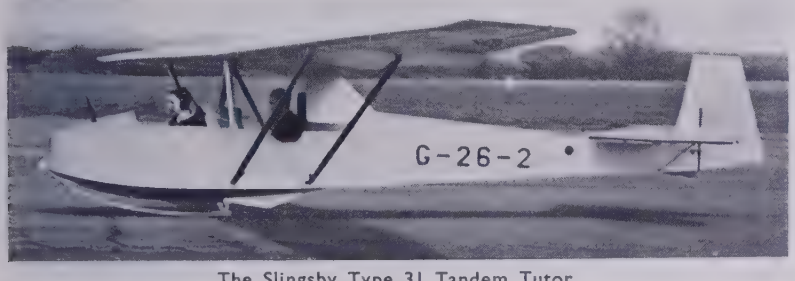
WEIGHTS. -
Weight empty 355 lb. (162 kg.).
Weight loaded 570 lb. (260 kg.).
Wing loading 2.98 lb./sq. ft. (14.6 kg./m.²)

THE SLINGSBY TYPE 31 TANDEM TUTOR.

This is another development of the Tutor intermediate type sailplane. It has been specially designed to make a low-priced dual-control glider available for training purposes. Most of the components are interchangeable with those of the solo Tutor, saving jig and tool costs and simplifying stores. The flying characteristics of the Tutor and Tandem Tutor are almost identical, so that the *ab initio* pilot can graduate from one to the other with ease.

DIMENSIONS.—
Span 43 ft. 4¾ in. (13.2 m.).
Gross wing area 170 sq. ft. (15.8 m.²).
Standard mean chord 3.94 ft. (1.2 m.).
Aspect ratio 11 : 1.

WEIGHTS.—
Tare weight 389 lb. (176.5 kg.).



The Slingsby Type 31 Tandem Tutor.

Disposable load 360 lb. (164 kg.).
All-up weight 750 lb. (341 kg.).

PERFORMANCE.
Sinking speed at 36 m.p.h. (58 km.h.) 3.4 ft./sec. (1.02 m./sec.).
Gliding angle at 45 m.p.h. (73 km.h.) 18.5 to 1.
Stalling speed 32 m.p.h. (51.5 km.h.).

THE SLINGSBY TYPE 21B SEDBERGH.

The Type 21B is a two-seat side-by-side training glider which has been designed to meet the requirements for a simple type of dual instruction sailplane of medium performance and low price, suitable for gliding clubs and other training organizations.

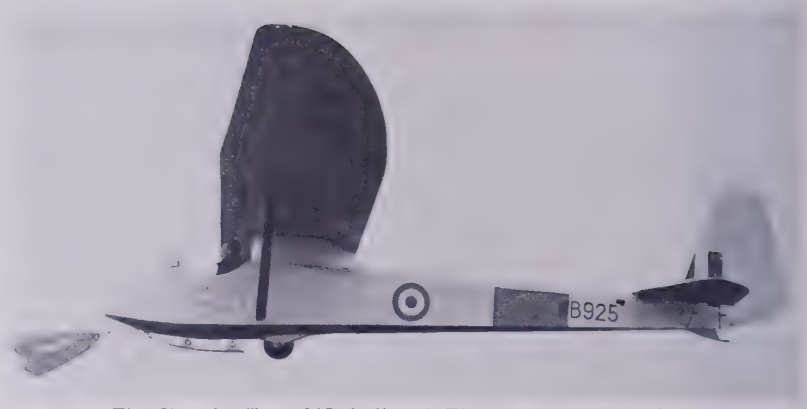
The Type 21B is in service with the R.A.F. Reserve Command and the Air Training Corps. In its service form it is named the Sedbergh TX Mk. 1.

TYPE.—Two-seat Training Glider.

WINGS.—High-wing braced monoplane. Single-spar torsion-resisting nose-box structure with light secondary spar to carry ailerons. Wood construction with fabric covering aft of main spar. Single bracing struts on each side. Standard mean chord 4 ft. 9½ in. (1.47 m.). Aspect ratio 11.2. Gross wing area 260 sq. ft. (24.15 m.²).

FUSELAGE.—Of mixed construction. Forward portion back to two main wing attachment-frames of wood stressed skin construction, remainder of fabric-covered girder construction.

TAIL UNIT.—Braced tailplane. Rudder and elevators are fabric-covered. Span 12 ft. 6¾ in. (3.67 m.).



The Slingsby Type 21B Sedbergh TX. Mk. I Training Glider.

LANDING GEAR.—Single central skid followed by single wheel. Spring tail-skid.

ACCOMMODATION.—Open cockpit seating two side-by-side with dual controls. Provision for back-type parachutes. Two control columns and dual rudder pedals. Quick-release and lift-spoiler controls placed centrally.

EQUIPMENT.—Instruments include A.S.I., Kollsman sensitive altimeter, Cobb-Slater variometer and Pullen electric turn-and-bank indicator. "Ottfur" type towing attachment mechanism.

DIMENSIONS.—
Span 54 ft. (16.47 m.).
Length 26 ft. 8 in. (8.13 m.).

WEIGHT EMPTY.—
608 lb. (280 kg.).

PERFORMANCE.—
Best gliding angle 1 in 21 at 42 m.p.h. (67.2 km.h.).
Min. sinking speed 2.8 ft./sec. (0.85 m./sec.) at 38 m.p.h. (60.8 km.h.).
Stalling speed 28 m.p.h. (41.6 km.h.).

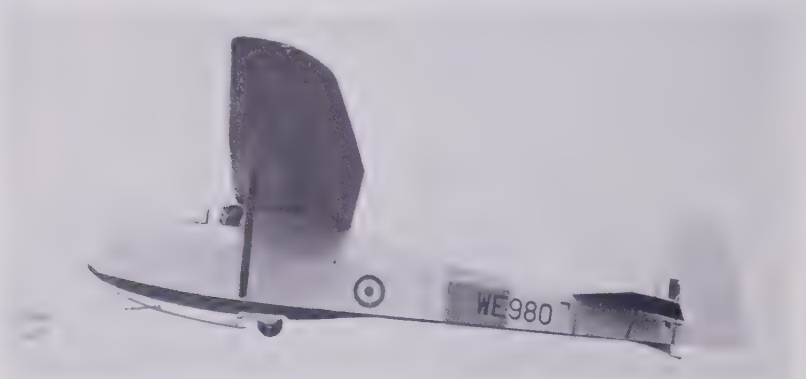
THE SLINGSBY TYPE 30 PREFECT.

The Prefect is an intermediate-type of sailplane in the semi-aerobatic category which was designed for use by civilian or service training organisations. It is suitable for cloud flying and cross-country flights, and includes among its equipment an airspeed indicator, sensitive altimeter, variometer, compass and electrical turn and bank indicator. Dive-brakes are a standard fitting. It is used by the R.A.F. as the Prefect TX. Mk. 1.

DIMENSIONS.—
Span 45 ft. (13.75 m.).
Length 20 ft. 8 in. (6.3 m.).
Height 4 ft. 2 in. (1.275 m.).
Max. wing chord 3 ft. 0½ in. (0.918 m.).
Tailplane span 9 ft. 2½ in. (2.8 m.).

WEIGHTS.—
Weight empty 390 lb. (177 kg.).

PERFORMANCE.—
Best gliding angle 1 in 21.
Min. sinking speed 2.6 ft./sec. (0.792 m. sec.).
Best flying speed 40 m.p.h. (64.6 km.h.).



The Slingsby Type 30 Prefect TX. Mk. I Sailplane. (*The Aeroplane*).

SUPERMARINE

VICKERS-ARMSTRONGS, LTD. (AIRCRAFT DIVISION.)

WORKS: HURSLEY PARK, WINCHESTER, HANTS, AND SOUTH MARSTON, SWINDON, WILTS.

LONDON OFFICE: VICKERS HOUSE, BROADWAY, WESTMINSTER, S.W.1.

Directors: See under "Vickers."

Superintendent (Supermarine Division): S. P. Woodley, M.B.E.

Chief Designer (Supermarine Division): J. Smith, C.B.E., F.R.Ae.S., A.M.I. Mech.E.

The original Supermarine Company was formed in 1912 and its efforts were chiefly devoted to the production of sea-going aircraft. The firm is famous for the design and production of the high-speed seaplanes which were successful in the Schneider Trophy Contests of 1927, 1929 and 1931, thus winning the Trophy outright for Great Britain. These seaplanes were also responsible for several World's Speed Records, and the last was made on September 29, 1931, when the winning S.6B, fitted with a special Rolls-Royce "sprint" engine raised the Record to 407.5 m.p.h. (655.8 km.h.).

In November, 1928, Vickers (Aviation) Ltd. took over the control of the Supermarine Aviation Works, Ltd. In October, 1938, the Supermarine Aviation Works (Vickers), Ltd., was with its parent company Vickers (Aviation), Ltd., taken over by Vickers-Armstrongs, Ltd.



The Supermarine Swift F. Mk. I Single-seat Fighter (Rolls-Royce Avon turbojet engine.)



The Supermarine Swift F. Mk. 4 Single-seat Fighter (Rolls-Royce Avon turbojet engine).

The Company's first landplane to go into production was the Spitfire, which first flew in 1936. Total production of the Spitfire, of which some twenty-nine different versions were built during the war, amounted to 21,767, including naval Seafires and 305 Spitfires built before the war.

The naval version of the Spitfire, known as the Seafire, went into service with the Fleet Air Arm in 1942. The final version was the Mk. 47.

On the marine side, Supermarine has built the Walrus, Sea Otter and Seagull, all single-engined amphibian flying-boats. The first two were produced in quantities and both were employed mainly on Air/Sea Rescue duties. The Seagull did not go into production.

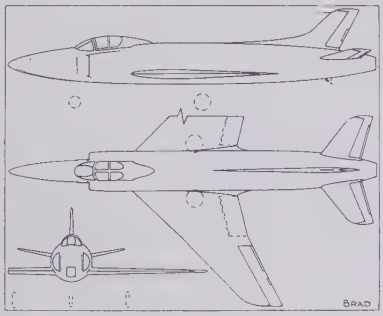
Supermarine's first jet-propelled fighter, the Attacker, is now in service in the Royal Navy. A swept-wing version, the Type 510, was built for experimental purposes, and the Type 535 was a further development. This latter model is succeeded by the Swift, which is now in "superpriority" production for the Royal Air Force.

THE SUPERMARINE SWIFT.

The Swift is a development of the Type 535, the principal difference between these two aircraft being that the Swift is powered with the Rolls-Royce Avon turbojet engine. The prototype made its first flight on August 5, 1951.

On July 10, 1952, the prototype Swift established an international point-to-point record between London and Brussels, covering the distance of 200.38 miles (320.6 km.) in 18 min. 3.3 sec., representing a speed of 665.9 m.p.h. (1,065.4 km.h.).

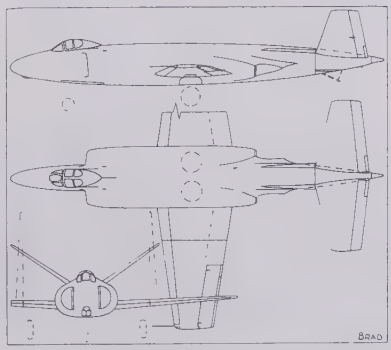
In March, 1953, it was announced that the Swift had exceeded the speed of sound on a number of occasions.



The Supermarine Swift F. Mk. 1.

The first production Swift F. Mk. 1 flew for the first time on August 25, 1952. The latest and current production version of the Swift is the F. Mk. 4. This differs from the initial production F. Mk. 1 by being powered by a Rolls-Royce Avon with afterburner, and by having increased armament. The wings also have compound leading-edge taper with increased sweep-back on the inner sections and each wing is fitted with two fences.

On July 5 a Swift Mk. 4 flew from London to Paris in 19 min. 5.6 sec. and back to London in 19 min. 14.3 sec. These times represent average speeds of 669.3 m.p.h. (1,077.4 km.h.) and 664.3 m.p.h. (1,069.3 km.h.), respectively, over the 212.5 miles between the two capitals.



The Supermarine Type 508.

The only details of the Swift available for publication at the time of going to press are as follow.

TYPE.—Single-seat Interceptor or Ground Attack Fighter.

WINGS.—Low-wing cantilever monoplane. 40° sweepback at 25% chord line. All-metal structure. Gross wing area 306 sq. ft. (28.43 m.²).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All surfaces swept back. Tailplane span 12 ft. 11 in. (3.93 m.).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction. Wheel track 15 ft. 2½ in. (4.64 m.). Wheelbase 14 ft. 10 in. (4.52 m.).

POWER PLANT.—One Rolls-Royce Avon axial-flow turbojet engine with re-heat.

ACCOMMODATION.—Single-seat cockpit. Jettisonable canopy. Ejection seat.

DIMENSIONS.—
Span 32 ft. 4 in. (9.86 m.).
Length 41 ft. 5½ in. (12.63 m.).
Height 13 ft. 6 in. (4.11 m.).

THE SUPERMARINE TYPE 508.

The Type 508, the most powerful fighter ever designed for aircraft-carrier operations, made its first flight on August 31, 1951. It carried out successful deck-landing trials in H.M.S. *Eagle* in May, 1952, and in April, 1953, the Admiralty announced that it had placed an order for a substantial quantity of a twin-engined fighter developed from the Type 508.

The following information applies specifically to the prototype Type 508.



The Supermarine Type 508 Single-seat Naval Fighter (two Rolls-Royce Avon turbojet engines).



The Supermarine Attacker F. Mk. 1 Single-seat Naval Fighter (Rolls-Royce Nene turbojet engine).

TYPE.—Single-seat Naval Fighter.

WINGS.—Low-wing cantilever monoplane. All-metal structure. Trailing-edge flaps inboard of ailerons. Drooping leading-edge. Wings fold upwards for carrier stowage. Gross wing area 340 sq. ft. (31.5 m.²).

FUSELAGE. All-metal structure.

TAIL UNIT.—Butterfly type. End cone of fuselage to which tail surfaces are attached is hinged for tail adjustment. Tail span 17 ft. 2½ in. (5.25 m.).

LANDING GEAR. Retractable nose-wheel type. Hydraulic retraction. Track 13 ft. 0¼ in. (3.96 m.).

POWER PLANT.—Two Rolls-Royce Avon axial-flow turbojet engines mounted in sides of fuselage with direct air entries and short tail pipes exhausting midway between trailing-edge of wing and leading-edge of tail.

ACCOMMODATION.—Single-seat cockpit. Sliding and jettisonable canopy. Ejection seat.

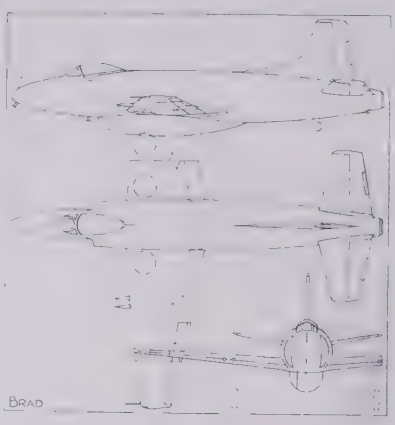
DIMENSIONS.

Span 41 ft. (12.5 m.).
Length 50 ft. (15.25 m.).
Height 11 ft. 7½ in. (3.54 m.).
Width folded 20 ft. (6.1 m.).

THE SUPERMARINE ATTACKER.

The Attacker was designed to Specification E.10/44, which was drawn up in 1944 to provide without delay a fighter which would derive full benefit from the 5,000 lb. thrust delivered by the Rolls-Royce Nene turbo-jet. To simplify production the wings and tail-wheel landing-gear of the piston-engined Spiteful were incorporated in the design.

The first prototype, which made its first flight on July 27,1946, was designed to meet R.A.F. requirements, but the second and third prototypes were built as naval aircraft to Specification E.1/45.



The Supermarine Attacker F. Mk. 1.

Successful carrier trials took place in October, 1947 in H.M.S. *Illustrious*, and the aircraft is now in production for the Royal Navy as the Attacker F. Mk. 1. In non-naval form it is also being produced for the Royal Pakistan Air Force.

On February 27, 1948, the first prototype Attacker (TS409) established a new international speed record over a 100 km. closed circuit with a speed of 564.881 m.p.h. (908.033 km.h.). For this record flight the Attacker carried its full military equipment and was standard in every way.

The Attacker has now been produced in the following forms :—

Attacker F. Mk. 1. Rolls-Royce Nene 3 engine (5,100 lb. = 2,315 kg. s.t.). First production version for Royal Navy. Interceptor fighter. No provision for bomb or rockets. First production F. Mk. 1 flew for the first time on April 5, 1950. Thirty-six Attackers without folding wings and other naval equipment supplied to the Royal Pakistan Air Force.

Attacker F.B. Mk. 1. Fighter bomber version of F. Mk. 1. Under wing racks for two 1,000-lb. bombs or four 60-lb. rockets. First F.B. Mk. 1 made its maiden flight on January 7, 1952.

Attacker F.B. Mk. 2. Rolls-Royce Nene 102 engine. Current production version for Royal Navy. Racks for two 1,000-lb. bombs or twelve 60-lb. rocket-projectiles. First production F.B. Mk. 2 flew on April 25, 1952.

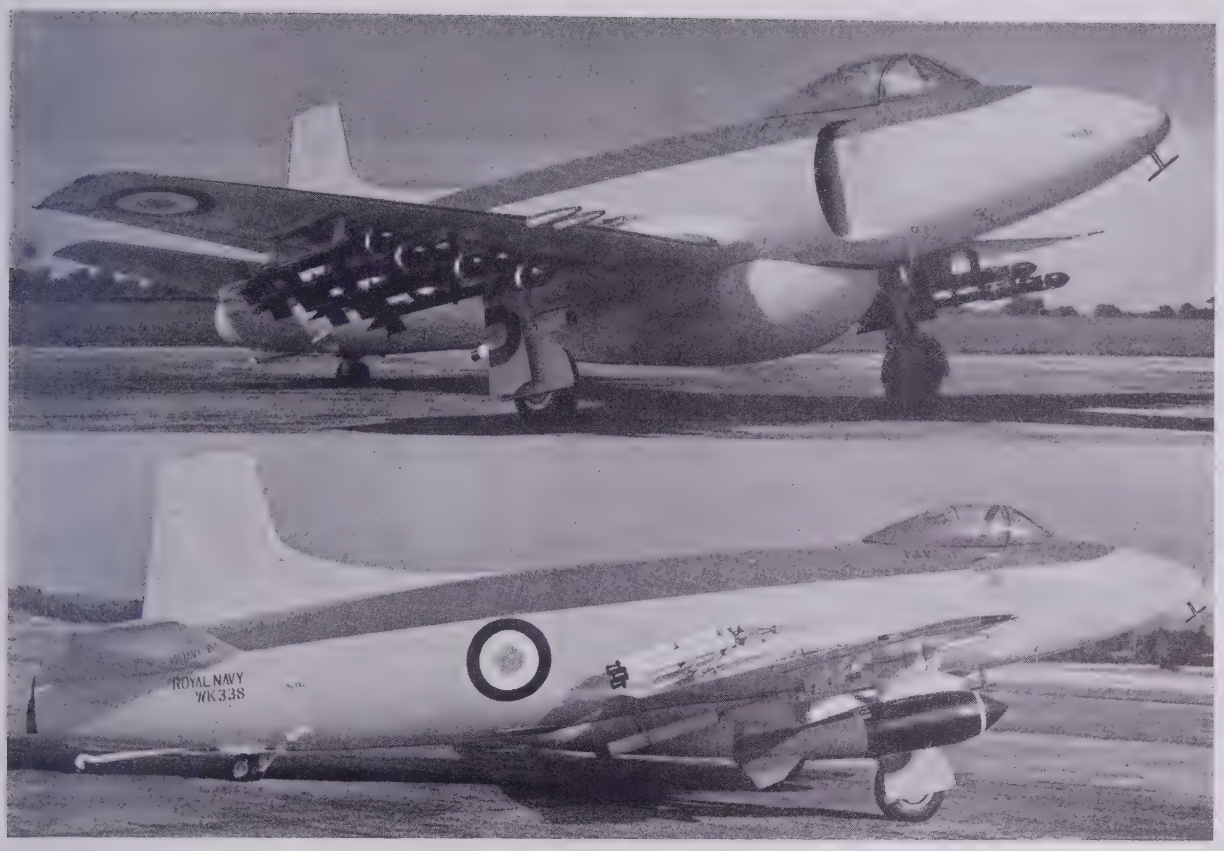
The description which follows refers to the Attacker F.B. Mk. 2.

TYPE.—Single-seat Naval Fighter-Bomber.

WINGS.—Low-wing cantilever monoplane. Supermarine 371-I/II laminar-flow section with thickness/chord ratio of 13% at root and 8% at tip. Position of thickness 40% at root, 42% at tip. Aspect ratio 6.1 : 1. Dihedral 5°. Incidence 2½°. Single main spar, auxiliary spar, former ribs and flush-riveted smooth metal skin. Split trailing-edge landing flaps between slotted ailerons and fuselage. Lift spoilers forward of the landing flaps. Spring tabs in ailerons, with electrically-operated tab with Miles actuator in starboard aileron outboard of spring tab. Outer three feet of each wing fold upward for carrier stowage. Total aileron area 17.23 sq. ft. (1.60 m.²). Total flap area 21.68 sq. ft. (2.0 m.²). Gross wing area 226.4 sq. ft. (21 m.²).



The Supermarine Attacker F. Mk. 1 Single-seat Naval Fighter (Rolls-Royce Nene turbojet engine).



The Supermarine Attacker F.B. Mk. 2 is here seen with its alternative rocket or bomb underwing armament.

FUSELAGE. — Aluminium-alloy stressed-skin structure.

TAIL UNIT.—Aluminium-alloy stressed-skin structure. Tailplane dihedral 10°. Adjustable trim tabs in rudder and both elevators, with spring tab inboard of trim tab in port elevator. Areas: tailplane and elevators 68 sq. ft. (6.31 m.²), fin and rudder 33 sq. ft. (3.0 m.²).

LANDING GEAR.—Conventional tail-wheel type with the main wheel struts having an 11 in. (28 cm.) stroke, but pre-retracting into the standard recess for 7 in. (17.8 cm.) stroke struts. Hydraulic retraction with compressed air emergency wheel-lowering system. Dunlop pneumatic wheel brakes. Twin-tyre tail-wheel assembly castoring 360° but lockable for take-off and landing. Track 14 ft. 6½ in. (4.42 m.).

POWER PLANT.—One Rolls-Royce Nene centrifugal-flow turbojet developing a maximum static thrust of 5,100 lb. (2,315 kg.) at 12,500 r.p.m. Segmental air intakes on each side of fuselage merge aft of pilot's cockpit into single pneumatically-sealed plenum bay in which engine is mounted. Seven internal fuel tanks, five in fuselage bay between pilot's cockpit and engine bay and two in wing roots. Total internal capacity 293 Imp. gallons (350 U.S. gallons=1,330 litres). Long-range external drop tank can be carried under fuselage with 250 Imp. gallons (300 U.S. gallons=1,135 litres) capacity.

ACCOMMODATION.—Pilot's cockpit forward of wings, armoured and pressurised to 3½ lb./sq. in. (0.246 kg./m.²) by air from blower casing controlled by Normalair constant-flow valve. Bullet-resisting windscreen and jettisonable sliding canopy. Silica-gel de-misting. Cordite-operated ejector seat. Provision for G-suit.

ARMAMENT.—Four 20 mm. British Hispano Mk. 5 cannon in wings with 167 rounds each for inboard guns and 145 rounds each for outboard guns. Two 1,000 lb. (454 kg.) bombs or twelve 60 lb. (27.2 kg.) rocket projectiles may be carried under wings.

DIMENSIONS.—
Span 36 ft. 11 in. (11.25 m.).
Length 37 ft. 6 in. (11.43 m.).
Height (tail down) 9 ft. 11 in. (3.02 m.).

WEIGHTS.—
Weight empty 9,910 lb. (4,500 kg.).
Normal max. take-off weight 12,300 lb. (5,584 kg.).
Max. overload take-off weight 17,350 lb. (7,877 kg.).
Normal aerodrome landing weight 13,000 lb. (5,900 kg.).
Normal deck landing weight 11,300 lb. (5,130 kg.).

PERFORMANCE.—
Max. speed (combat rating at 95% normal weight) at sea level 590 m.p.h. (944 km.h.).
At 10,000 ft. (3,050 m.) 583 m.p.h. (932.8 km.h.).
At 20,000 ft. (6,100 m.) 561 m.p.h. (897.6 km.h.).
At 30,000 ft. (9,150 m.) 538 m.p.h. (860.8 km.h.).
Average cruising speed 380 m.p.h. (608 km.h.).
Rate of climb (combat rating) at initial weight of 11,500 lb. (5,221 kg.) at sea level 6,350 ft./min. (1,937 m./min.).
At 10,000 ft. (3,050 m.) 5,250 ft./min. (1,601 m./min.).
At 20,000 ft. (6,100 m.) 4,160 ft./min. (1,269 m./min.).
At 30,000 ft. (9,150 m.) 2,860 ft./min. (872 m./min.).
Time to 10,000 ft. (3,050 m.) 1.72 min.
To 20,000 ft, (6,100 m.) 3.84 min.
To 30,000 ft. (9,150 m.) 6.66 min.
Operational ceiling 45,000 ft. (13,725 m.).
Range (normal fuel) 590 miles (949 km.), including climb, at 338 m.p.h. (544 km.h.).
Max. range (with external drop tank) 1,190 miles (1,915 km.) at 355 m.p.h. (571 km.h.).

(NOTE.—The ranges and endurances quoted are after allowance has been made for two minutes at take-off power and ten minutes for landing).

VICKERS

VICKERS-ARMSTRONG LTD. (AIRCRAFT DIVISION).

AVIATION WORKS: WEYBRIDGE, SURREY.

LONDON OFFICE: VICKERS HOUSE, BROADWAY, WESTMINSTER S.W.1.

Directors: Sir James Reid Young, C.A., F.C.I.S. (Chairman); Major-General C. A. L. Dunphie, C.B., C.B.E., D.S.O. (Deputy Chairman and Managing Director); P. H. Carey; G. R. Edwards, C.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E. (General Manager and Chief Engineer, Aircraft Division); T. Gammon, O.B.E., M.I.Mech.E. (Deputy General Manager, Aircraft Division); A. H. Hird, A.C.G.I., B.Sc., M.I.Mech.E.; G. H. Houlden, M.B.E. (Managing Director, Shipbuilding Division); F. P. Laurens, O.B.E., M.I. Mech.E. (Deputy Managing Director, Engineering Division); C. W. Moss; P. H. Muirhead, C.B.E. (Managing Director, Engineering Division); W. D. Opher, M.I.Mech.E.; Vice-Admiral Sir Charles E. B. Simeon, K.B.E., C.B.; E. J. Waddington, A.C.A.; R. P. H. Yapp; A. O. Bluth.

Chief of Aeronautical Research and Development: B. N. Wallis, C.B.E., F.R.S., R.D.I., B.Sc. (Hon.), M.Inst. C.E., F.R.Ae.S.

Chief Designer, Aircraft: B. Stephenson, A.F.R.Ae.S.

Chief Designer, Guided Weapons: H. H. Gardner, B.Sc., F.R.Ae.S.

Superintendent, Aircraft Division: R. Edmonds, M.B.E.

Vickers (Aviation), Ltd. was formed in July, 1928, when Vickers, Ltd. formed their Aviation Department into a separate subsidiary company to take over the manufacture of aircraft, aircraft accessories and equipment. In November, 1928, Vickers (Aviation), Ltd. took over the control of the Supermarine Aviation Works, Ltd.

In October, 1938, Vickers (Aviation), Ltd. and the Supermarine Aviation Works (Vickers), Ltd. were taken over by Vickers-Armstrongs, Ltd.

Vickers aircraft were operated in the 1914-18 War and subsequently have covered a wide range of types in both military and civil spheres.

The first post-war production of Vickers-Armstrongs' Weybridge Works was the V.C.1 Viking, which was produced in large numbers for use by airlines of many nations. Military versions of the Viking, the Valetta military transport and the Varsity crew trainer, have been built for the Royal Air Force.

The latest civil aircraft to be developed by Vickers-Armstrongs is the Viscount. The Viscount was the first civil airliner powered with turboprop engines to fly. It was also the first turboprop-powered airliner to go into regular scheduled airline services.

The latest Vickers military aircraft is the Valiant, the first four-jet bomber to go into production for the Royal Air Force.

THE VICKERS TYPE 1000.

The Type 1000 has been ordered as a military transport prototype, but a civil airliner version is projected. This aircraft is a low-wing monoplane with a wing form similar to that of the Valiant. It will be powered by four Rolls-Royce Conway by-pass turbojet engines buried in the wings. The Type 1000 is intended for operation over very long distances at high subsonic speeds. The civil version will have accommodation for between 100 and 150 passengers. No further details are available for publication.

DIMENSIONS (approx.). -
Span 140 ft. (42.67 m.).
Length 146 ft. (44.5 m.).
Height 38 ft. 6 in. (11.73 m.).

THE VICKERS TYPE 674 VALIANT.

The Valiant is a four-jet high-performance swept-wing bomber which is in "super-priority" production for the Royal Air Force. It is powered by four Rolls-Royce Avon turbojet engines. The first prototype flew for the first time on May 18, 1951, and the second prototype made its maiden flight on April 11, 1952.

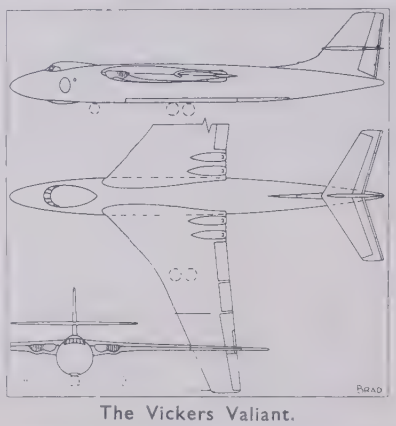
No further details of the Valiant were available for publication at the time of writing.

THE VICKERS VISCOUNT 700 SERIES.

The original design concept of the Viscount as a 24-passenger airliner began in 1945 at a time when the Rolls-Royce Dart engine was expected to develop about 800 s.h.p. When, however, the Dart reached practical form it was found that it could yield at least 1,000 s.h.p. The decision was then made to build the first Viscount, the Type 630, as a 32-passenger aircraft, and this prototype, famous as being the first civil airliner to be powered by turboprop engines, made its maiden flight on July 16, 1948.



A model of the Vickers Type 1000 Transport.



The Vickers Valiant.

In 1949 the construction of a second Viscount, the Type 700, was started. By this time the Dart was developing 1,400 s.h.p. and in consequence it was possible to "stretch" the aircraft to accommodate 40-48 passengers. The fuselage was lengthened by 6 ft. 8 in. (2.03 m.) and the overall wing span was increased by 5 ft. (1.525 m.). The prototype 700 flew for the first time on August 28, 1950. From this aircraft the following production versions have been evolved.

Type 701. Four Rolls-Royce Dart RDa.3 (Dart 505) engines each developing 1,550 e.h.p. Production version for



Two views of the Vickers Valiant Bomber (four Rolls-Royce Avon turbojet engines).



The prototype Vickers Viscount 700 Airliner (four 1,400 s.h.p. Rolls-Royce Dart turboprop engines).

British European Airways. Differs from Type 700 in having extra large underfloor freight hold with two external loading hatches, and external freight door giving access to rear above-floor freight compartment. Crew of three, pilot, co-pilot and radio operator. First production 701 flew on August 20, 1952. Twenty-six in process of delivery to B.E.A. With the first of these, British European Airways inaugurated the World's first turboprop-powered passenger services on April 18, 1953.

Type 702. Three ordered by British West Indian Airways.

Type 707. Four ordered by Aer Lingus (Irish Air Lines).

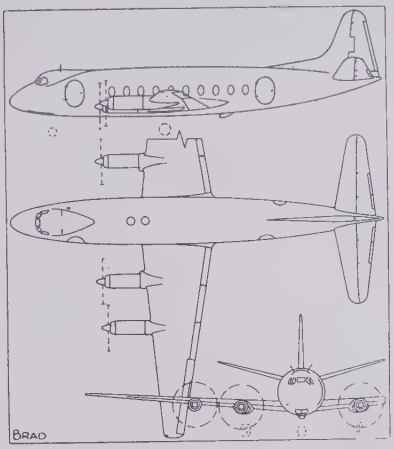
Type 708. Twelve ordered by Air France. First aircraft of this order flew on March 11, 1953.

Type 720. Six ordered by Trans-Australia Airlines.

Type 724. Fifteen ordered by Trans-Canada Air Lines. To have special provisions for cold weather flying, including additional heating for passengers, crew and baggage compartments, increased electrical power, etc. All-up weight 58,500 lb. (26,560 kg.). Deliveries to begin in September, 1954.

Type 732. Three ordered by Hunting Air Transport, Ltd.

All these types are substantially the same, differing only in accommodation and



The Vickers Viscount 700 Series.

equipment to suit individual operators.

The description below refers to the Viscount 700 Series in general.

TYPE—Four-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Aerofoil section NACA 63 modified. Aspect ratio 9.17. All-metal structure with stressed Alclad skin. Double-slotted flaps between Irving-type ailerons and fuselage. Thermal de-icing. Root chord 14 ft. 10 in. (4.54 m.). Tip chord 4 ft. 5 in. (1.35 m.). Dihedral 4° 30′. Aileron area (including tabs) 71.8 sq. ft. (6.67 m.²). Total flap area 156 sq. ft. (14.43 m.²). Gross wing area 963 sq. ft. (89.3 m.²).

FUSELAGE.—All-metal stressed-skin structure. The entire fuselage except nose-wheel retraction bay and extreme rear is pressurized to 6½ lb./sq. in. (0.45 kg./cm.²).

TAIL UNIT.—Cantilever monoplane structure. Single fin and rudder and 15° dihedral on tailplane. All-metal construction. Spring tabs in all control surfaces. Thermal de-icing. Total tailplane area 134 sq. ft. (12.4 m.²). Elevator area (including tabs) 104 sq. ft. (9.67 m.²). Fin area 66 sq. ft. (6.13 m.²). Rudder area 62 sq. ft. (5.75 m.²).

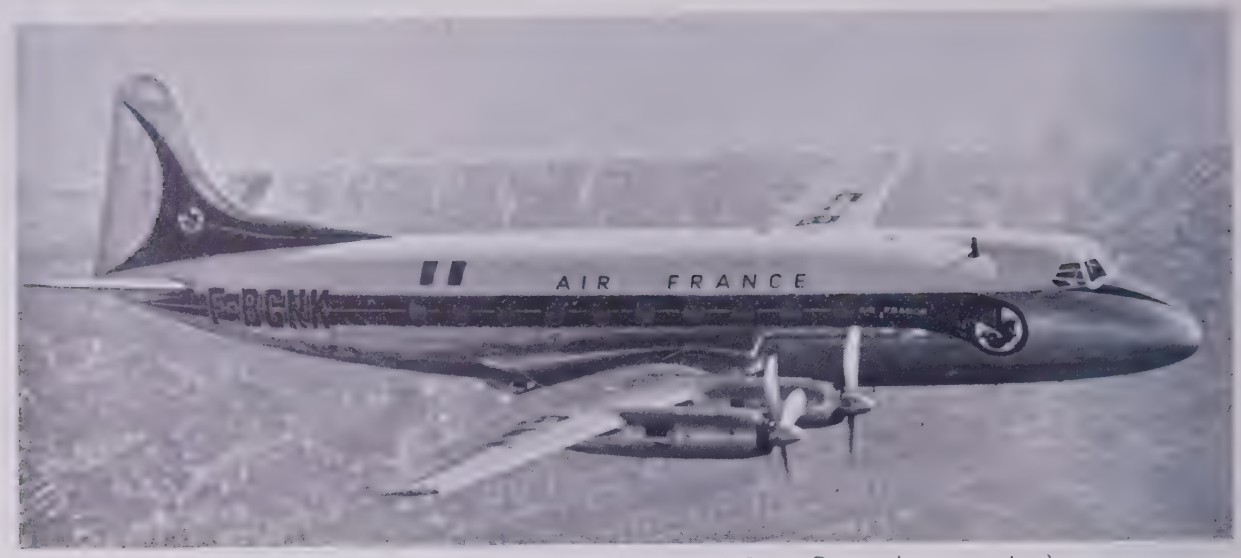
LANDING GEAR.—Retractable tricycle type, hydraulically-operated. All units have single Vickers shock-absorbers supporting twin wheels. Dunlop or Goodyear wheels and brakes. Wheel track 23 ft. 10 in. (7.27 m.); wheel base 24 ft. 10.6 in. (7.58 m.).

POWER PLANT.—Four Rolls-Royce Dart 504 turboprop engines, each driving a four-blade Rotol fully-feathering 10 ft. (3.05 m.) diameter airscrew. Max. output per engine 1,400 h.p. plus 365 lb. (165 kg.) of jet thrust. Total max. fuel capacity 1,720 Imp. gallons (7,810 litres) in bag-type tanks forward and aft of main wing spar. Water-methanol system for boosted take-off; total capacity 75 Imp. gallons (340 litres).

ACCOMMODATION.—Normal accommodation for 40 passengers, but up to 62 can be seated in high-density version. Normal crew of three or four, comprising two pilots and one or two stewards. Separate crew station for radio-operator/navigator optional; when not carried, radio and



The Vickers Viscount 701 Airliner (four 1,400 h.p. Rolls-Royce Dart turboprop engines).



The Vickers Viscount 708 Airliner (four 1,400 h.p. Rolls-Royce Dart turboprop engines).

radar are operated by remote control from second pilot's seat. Pantry forward of main cabin, toilet compartment at the rear. Three large freight and luggage compartments, one forward of main cabin, capacity 110 cub. ft. (3.11 m.³) one aft with separate door on starboard side, capacity 204 cub. ft. (5.77 m.³) one below floor level forward, with two access doors, capacity 215 cub. ft. (6.08 m.³). Continuous main passenger cabin with seats each side of central gangway. Cabin height 6 ft. 5 in. (1.96 m.). Max. floor width 8 ft. 8 in. (2.64 m.). Combined pressurization, air-conditioning and temperature control, giving ground-level conditions up to 15,000 ft. (4,575 m.) and 8,000 ft. (2,440 m.) conditions at 30,000 ft. (9,150 m.). Air-conditioning system may be operated on ground without running engines.

DIMENSIONS.—
Span 94 ft. 0 in. (28.5 m.).
Length 81 ft. 2 in. (24.4 m.).
Height 26 ft. 9 in. (8.05 m.).

WEIGHTS (700 Series—2 crew 40 passengers layout).—
Weight empty (equipped) 33,075 lb. (15,016 kg.).
Max. payload 13,315 lb. (6,045 kg.).
Disposable load 25,425 lb. (11,543 kg.).
Max. loaded weight 58,500 lb. (26,560 kg.).
Max. landing weight 52,000 lb. (23,608 kg.).

WEIGHTS (700 Series—3 crew 40 passenger layout).—
Weight empty (equipped) 33,115 lb. (15,035 kg.).
Max. payload 13,589 lb. (6,169 kg.).
Disposable load 25,385 lb. (11,525 kg.).
Max. loaded weight 58,500 lb. (26,560 kg.).
Max. landing weight 52,000 lb. (23,608 kg.).

PERFORMANCE.—
Max. cruising speed at 25,000 ft. (7,625 m.) at 50,000 lb. (22,700 kg.) 314 m.p.h. (502 km.h.).
Normal operational cruising speed at 20,000 ft. (6,100 m.) at 50,000 lb. (22,700 kg.) 321 m.p.h. (514 km.h.).
Rate of climb at 58,500 lb. (26,560 kg.), I.C.A.N. conditions flaps up, on four engines, 930 ft./min. (284 m./min.) at sea level and 370 ft./min. (113 m./min.) at 15,000 ft. (4,575 m.).
Rate of climb at 58,500 lb. (26,560 kg.), I.C.A.N. conditions, 20° flap and undercarriage up, take-off power and one engine inoperative 540 ft./min. (165 m./min.) at 6,000 ft. (1,829 m.).
Service ceiling 26,700 ft. (8,142 m.) at 52,000 lb. (23,608 kg.).
Take-off distance to 50 ft. (15.2 m.) at 58,500 lb. (26,560 kg.). I.C.A.N. sea level conditions, four engines, 1,520 yds. (1,391 m.).
Take-off distance to 50 ft. (15.2 m.) at 58,500 lb. (26,560 kg.), I.C.A.N. sea level conditions, with one engine failure at critical point, 1,740 yds. (1,592 m.).
Landing distance from 50 ft. (15.2 m.) at 52,000 lb. (23,608 kg.). I.C.A.N. conditions, 886 yds. (811 m.).
Range and payload depend on operational requirement and fuel reserves.

THE VICKERS VISCOUNT 800 SERIES.

The Viscount 800 is a "stretched" version of the 700, again made possible by a further augmentation of power of the Rolls-Royce Dart engine. Twelve Type 801's have been ordered by British European Airways for delivery in 1955.

The fuselage of the Type 800 will be 160 inches (4.05 m.) longer than that of the 700. This will permit the addition of four extra rows of seats, and raise the total accommodation to 66 first-class or 82 tourist class passengers.

The 800 will be powered by four 1,690 e.h.p. Rolls-Royce Dart RDa.5 engines.

DIMENSIONS.—
Same as 700 Series except:
Length 94 ft. 6 in. (28.82 m.).

WEIGHTS AND LOADINGS (Designed).—
Weight empty 39,112 lb. (11,756 kg.).
Max. payload 16,820 lb. (7,636 kg.).
Max. disposable load 25,888 lb. (11,733 kg.).
Normal loaded weight 65,000 lb. (29,510 kg.)
Max. landing weight 61,000 lb. (27,694 kg.).
Wing loading (at normal A.U.W.) 67.5 lb./sq. ft. (329.4 kg./m.²).
Power loading (at normal A.U.W.) 9.6 lb./e.h.p. (4.35 kg./e.h.p.).

PERFORMANCE (Estimated).—
Max. continuous cruising speed 312 m.p.h. (499 km.h.) at 20,000 ft. (6,100 m.).
Economic cruising speed 290 m.p.h. (464 km.h.) at 16,000 ft. (4,880 m.).
Rate of climb at max. continuous cruise power 1,120 ft./min. (342 m./min.).
Service ceiling 25,600 ft. (7,810 m.).
Take-off distance to 50 ft. (15.25 m.) 1,830 yds. (1,675 m.).
Landing distance from 50 ft. (15.25 m.) 1,120 yds. (1,025 m.).
Stalling speed at max. landing weight 106 m.p.h. (170 km.h.).
RANGES (allowing for 45 min. stand-off at 5,000 ft.=1,525 m. and 230 miles=368 km. diversion).—
With 16,100 lb. (7,310 kg.) payload 350 miles (560 km.).
With 13,400 lb. (6,084 kg.) payload 700 miles (1,120 km.).
With 10,300 lb. (4,676 kg.) payload 1,100 miles (1,760 km.).

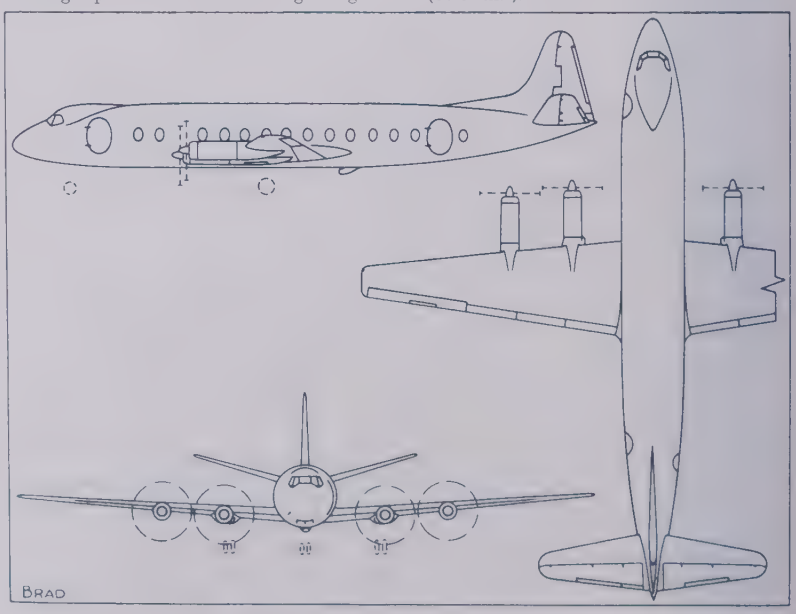
THE VICKERS TYPE 668 VARSITY.

The Varsity general-purpose aircrew trainer retains the general characteristics of the Valetta C. Mk. 1, but has a tricycle nose-wheel landing-gear and a slightly longer forward fuselage. For bomb-aimer training, a bomb-bay and bomb-aiming station have been provided in the form of a pannier fitting against the fuselage belly. The wing span and the area of the split flaps have been increased slightly as compared with the Valetta.

The first flight of the Varsity was made in July, 1949 and the first Varsity T. Mk. 1's went into service in the R.A.F. in 1951.

TYPE.—Twin-engined General-purpose Aircrew Trainer.

WINGS.—Mid-wing cantilever monoplane. All-metal single-spar stressed skin construction. Frise-type ailerons with Westland-Irving balance in outer wings and hydraulically-operated split trailing-edge flaps between ailerons and fuselage. Porous-metal fluid de-icing. Flap area 101 sq. ft. (9.4 m.²). Gross wing area 974 sq. ft. (90.9 m.²).



The Vickers Viscount 800 Series Airliner.



The Vickers Varsity T. Mk. 1 Aircrew Trainer (two 1,950 h.p. Bristol Hercules 264 engines).

FUSELAGE.—Light-alloy structure. Max. fuselage width 8 ft. 8½ in. (2.66 m.). Max. fuselage height 10 ft. 5 in. (3.17 m.).

TAIL UNIT.—Cantilever monoplane type. Construction similar to wings. Inset trim tabs in rudder and elevators.

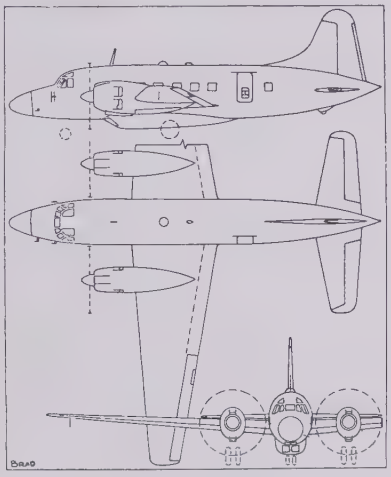
LANDING GEAR.—Retractable nose-wheel type. All units have single cantilever oleo-pneumatic shock-absorber struts and twin wheels. Nose-wheel unit steerable. Hydraulic retraction. Wheel track 25 ft. 11 in. (7.92 m.). Wheel base 18 ft. 1 in. (5.52 m.).

POWER PLANT.—Two 1,950 h.p. Bristol Hercules 264 fourteen-cylinder two-row radial air-cooled sleeve-valve engines. Rotol four-blade constant-speed fully-feathering airscrews, diameter 14 ft. (4.26 m.). Four flexible fuel tanks in outer wings and provision for two tanks in inner wings.

ACCOMMODATION.—Flight deck in forward fuselage seating student pilot and instructor side-by-side, with student signaller and instructor immediately behind. Side-by-side bomb-aiming station for instructor and student in nose of underslung nacelle. Station for instructor and two navigator students in rear fuselage aft of main spar.

EQUIPMENT. — H2S, Rebecca, Automatic Radio Compass and Intercomm. in fuselage. 3 ft. (0.93 m.) radar scanner in nose. Sextant in dome over navigator instructor's seat. Camera below floor in rear fuselage. Flare chute at rear, with stowage for 6 flares and 27 flame floats. Bomb-bay in underslung nacelle, with stowage for twenty-four 25 lb. (11.35 kg.) practice bombs.

DIMENSIONS.—
Span 95 ft. 7 in. (29.1 m.).



The Vickers Varsity Aircrew Trainer.

Length 67 ft. 6 in. (20.6 m.).
Height overall 23 ft. 11 in. (7.3 m.).

WEIGHTS AND LOADINGS.—
Tare weight 27,040 lb. (12,280 kg.).
Basic operational equipped weight 30,020 lb. (13,650 kg.).
Max. all-up weight 37,500 lb. (17,030 kg.).
Max. landing weight 36,000 lb. (16,350 kg.).
Wing loading 38.5 lb./sq. ft. (188 kg./m.²).
Power loading 9.61 lb./h.p. (4.36 kg./h.p.).

PERFORMANCE.—
Max. weak mixture cruising speed (34,800 lb.=15,800 kg. A.U.W.) at 10,000 ft. (3,050 m.) 240 m.p.h. (386 km.h.).
Normal operation cruising speed (34,800 lb.=15,800 kg. A.U.W.) at 10,000 ft. (3,050 m.) 210 m.p.h. (338 km.h.).
Rate of climb, I.C.A.N. conditions, flaps up, on two engines, 1,400 ft./min. (427 m./min.) at sea level and 1,180 ft./min. (360 m./min.) at 10,000 ft. (3,050 m.).
Rate of climb, I.C.A.N. conditions, flaps up, climb power and one engine inoperative 175 ft./min. (54 m./min.) at 10,000 ft. (3,050 m.).
Service ceiling 27,000 ft. (8,240 m.).
Take-off distance to 50 ft. (15.2 m.), I.C.A.N. sea level conditions, on two engines 1,140 yds. (1,042 m.).
Take-off distance to 50 ft. (15.2 m.), I.C.A.N. sea level conditions, with one engine failure at critical point, 1,680 yds. (1,535 m.).
Landing distance from 50 ft. (15.2 m.) at 33,450 lb. (15.140 kg.), I.C.A.N. sea level conditions 1,130 yds. (1,032 m.).

THE VICKERS TYPE 651 VALETTA.

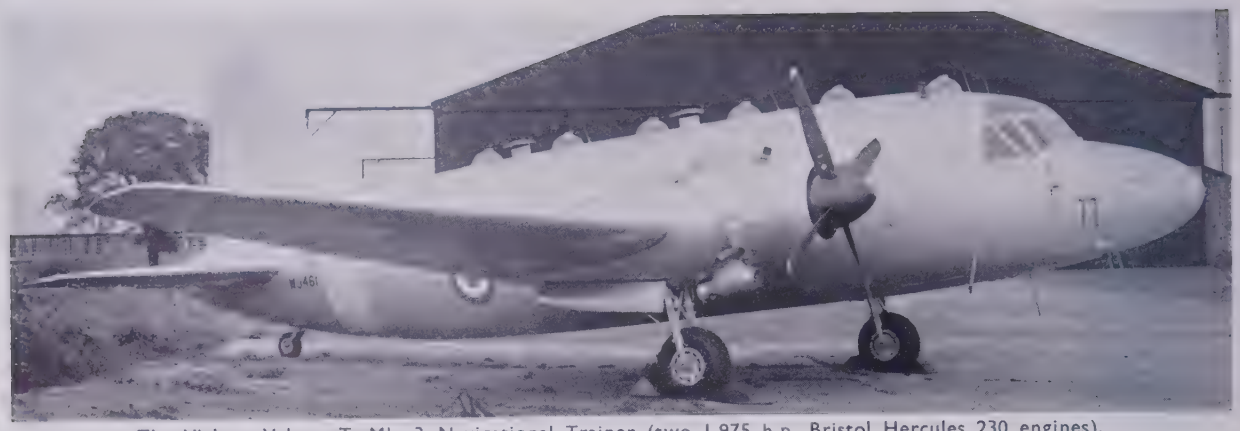
Three main versions of the Valetta have been produced, as follows :—

Valetta C. Mk. 1. Standard version for use by the Airborne Forces, and available for various rôles, such as troop-carrying, freighting, paratroop-carrying, supply dropping, and as an ambulance. Prototype first flew on June 30, 1947.

Valetta C. Mk. 2. A V.I.P. version seating nine to fifteen passengers. Interior arrangement includes a pantry, toilet



The Vickers Valetta C. Mk. 1 Transport (two 1,975 h.p. Bristol Hercules 230 engines).



The Vickers Valetta T. Mk. 3 Navigational Trainer (two 1,975 h.p. Bristol Hercules 230 engines).

compartment and stowage for baggage. The addition of a fuel tank in each nacelle, capacity 58 Imp. gallons (263 litres) each, increases the range to 1,345 miles (2,152 km.) in still air, plus 20% reserve at normal cruising speed at 10,000 ft. (3,050 m.).

Valetta T. Mk. 3. A version designed specifically for use as a navigational flying classroom. Basically similar to C. Mk. 1, apart from special internal equipment and line of six astrodomes along top of the fuselage. Prototype first flew on August 31, 1950.

TYPE.—Twin-engined Military Transport.

WINGS.—Cantilever mid-wing monoplane. Aspect ratio 9; root chord 14 ft. 7 in. (4.45 m.); tipchord 4 ft. 2 in. (1.27 m.); mean chord 9.88 ft. (3.01 m.). All-metal structure. Inner wing sections of geodetic construction with unstressed Alclad skin, outer sections are of stressed skin construction. Frise-type ailerons with adjustable hand trim-tab in port and preset tab in starboard. Schrenk split trailing-edge flaps between ailerons and fuselage. Hydraulic operation. Gross wing area 882 sq. ft. (81.93 m.²).

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal tailplane and fin, metal-framed fabric-covered elevators and rudder. Rudder has single combined spring-tab and hand trim-tab for heavy and light loads respectively. Differential elevator tabs; controllable tab in port, and balance tab in starboard. Tailplane span 36 ft. 0 in. (10.95 m.).

LANDING GEAR.—Retractable tail-wheel type. Vickers oleo-pneumatic shock-absorber struts. Hydraulic retraction. Track 22 ft. 10 in. (6.96 m.), wheel base 33 ft. 5 in. (10.17 m.).

POWER PLANT.—Two 1,975 h.p. Bristol Hercules 230 nine-cylinder radial air-cooled engines driving D.H. or Rotol four-blade constant-speed feathering airscrews 13 ft. 3 in. (4.04 m.) diameter. Four flexible self-sealing fuel tanks in wings, two of 172 Imp. gallons (783 litres) and two of 190 Imp. gallons (865 litres) capacity. Total fuel capacity 724 Imp. gallons (3,294 litres).

ACCOMMODATION.—Crew of four comprising two pilots, navigator and radio operator. Main cabin has total floor area of 236 sq. ft. (21.9 m.²), 73 sq. ft. (6.8 m.²) forward and 163 sq. ft. (15.1 m.²) aft of spar. Main entrance door on port side aft with additional freight door to give maximum opening for loading light vehicles, bulky freight, etc. Freight tie-down points in floor and sides of fuselage. Equipment and fittings designed for rapid interchangeability of *roles*. Removable equipment includes troop seats, vehicle ramps and runways over spar, paratroop seats, container carriers, stretchers, orderlies' seats, etc. Cargo hold below main floor runs entire length of fuselage, with four doors, all accessible from ground. Total volume of main cabin 1,565 cub. ft. (44.3 m.³).

DIMENSIONS.—
Same as for Viking except length 62 ft. 11 in. (19.1 m.).

WEIGHTS AND LOADINGS.—
Common basic weight 25,061 lb. (11,370 kg.).
Disposable load 11,439 lb. (5,180 kg.).
Normal take-off weight 36,500 lb. (16,556 kg.).
Max. landing weight 35,500 lb. (16,102 kg.).
Wing loading (at take-off weight) 41.4 lb./sq. ft. (202 kg./m.²).
Power loading 9.24 lb./h.p. (4.19 kg./h.p.).

TYPICAL LOADINGS.—
Max. load and corresponding still air range respectively, at 172 m.p.h. (275 km.h.), with allowance for climb to 10,000 ft. (3,050 m.).
Troop Carrier, basic weight 26,566 lb. (12,050 kg.), 34 troops at 220 lb. (100 kg.) each, 316 miles (508 km.).
Freighter, basic weight 25,061 lb. (11,380 kg.), freight and lashings 8,835 lb. (4,007 kg.), 357 miles, (575 km.).
Paratroop Carrier, basic weight 25,795 lb. (11,700 kg.), 20 troops plus six 350 lb. (160 kg.) containers, 523 miles (841 km.).
Supply Dropper, basic weight 25,654 lb. (11,640 kg.), twelve 350 lb. (160 kg.) containers on double track roller conveyer, plus three despatchers, 1,320 miles (2,125 km.).
Ambulance, basic weight 25,863 lb. (11,740 kg.), 20 stretcher and two sitting cases plus two orderlies, 1,265 miles (2,035 km.).

PERFORMANCE.—
Max. speed 294 m.p.h. (472 km.h.) at 5,500 ft. (1,680 m.).
Or 291 m.p.h. (469 km.h.) at 10,000 ft. (3,050 m.).
Max. weak mixture cruising speed 265 m.p.h. (427 km.h.) at 10,000 ft. (3,050 m.).
Economical cruising speed 172 m.p.h. (276 km.h.) at 10,000 ft. (3,050 m.).
Climb to 10,000 ft. (3,050 m.) 8 min.
Service ceiling 22,200 ft. (6,770 m.).
Range at 10,000 ft. (3,050 m.) up to 1,290 miles (2,075 km.) at 211 m.p.h. (340 km.h.) or 1,410 miles (2,270 km.) at 172 m.p.h. (276 km.h.) depending on load.
Take-off to clear 50 ft. (15.25 m.) 1,250 yds. (1,145 m.).
Landing from 50 ft. (15.25 m.) 1,425 yds. (1,305 m.).

WESTLAND

WESTLAND AIRCRAFT, LTD.

HEAD OFFICE, WORKS AND AERODROME: YEOVIL, SOMERSET.

LONDON OFFICE: 8, THE SANCTUARY, WESTMINSTER, S.W.1.

Directors: Eric Mensforth, C.B.E., M.A., M.I.Mech.E., M.I.P.E. (Chairman); Lord Aberconway (Deputy Chairman); Edward C. Wheeldon, M.I.P.E. (Managing Director); D. L. Hollis Williams, B.Sc., F.R.Ae.S. (Technical Director); D. C. Collins, M.I.Mech.E., M.I.P.E. (Works Director); John Fearn, M.I. Mech.E., A.F.R.Ae.S.; Sir George E. Bailey, C.B.E.; Sir H. W. Hugh Warren, D.Sc.; S. W. Rawson.

Chief Designer (Aircraft): F. J. W. Wingfield Digby, M.A., F.R.Ae.S.

Chief Designer (Helicopters): O. L. L. Fitzwilliams, B.A. (Eng.) Cantab.

Secretary: W. B. Hickman, A.C.A.

Westland Aircraft, Ltd. was formed in July, 1935, to take over the aircraft branch of Petters, Ltd., previously known as the Westland Aircraft Works, which had been engaged in aircraft design and construction since 1915.

Since the war Westland has developed the Wyvern Naval Strike aircraft which is now in production in its Mk. 4 version, and has been engaged in helicopter development. The Westland-Sikorsky S-51 was the first helicopter of British manufacture to receive a Certificate of Airworthiness and is being produced in both military and civil versions. More recently Westland has acquired the licence to build the Sikorsky S-55 helicopter, which has also been put into production.

A subsidiary company, Normalair, Ltd., carries out research and development work in the problems of cabin air control in high altitude flight, and manufactures and sells equipment for such purposes. Normalair equipment is used in all British pressurised aircraft and a number of foreign designs, including the Gloster Meteor, de Havilland Vampire, English Electric Canberra, Supermarine Attacker, Bristol Brabazon 1 and 2 and Type 175, Airspeed Ambassador, A. V. Roe Canada CF.100 and C.102, de Havilland Comet, Handley Page Hermes, Vickers Viscount and Dassault Ouragan.

THE WESTLAND WYVERN.

The Wyvern Single-seat Strike Fighter was designed to the requirements of the Royal Navy and is now in production in its latest Mk. 4 form. The stages of development of the Wyvern are as follow:

Wyvern T.F. Mk. 1. One 3,500 h.p. Rolls-Royce Eagle 24-cylinder flat H sleeve-valve engine driving a Rotol eight-blade co-axial contra-rotating airscrew. First flew on December 12, 1946.

Wyvern T.F. Mk. 2. One Armstrong Siddeley Python turboprop engine developing 3,670 s.h.p. and 1,150 lb. (520 kg.) s.t. Rotol eight-blade co-axial contra-rotating airscrew. First T.F. Mk. 2 flew on March 22, 1949, and first carrier trials began in H.M.S. *Illustrious* on June 21, 1950.

Wyvern T. Mk. 3. A two-seat dual-control version of T.F. Mk. 2. Tandem cockpits with instructor in rear seat. First flew in February 11, 1950.

Wyvern S. Mk. 4. Present production version, to which the description below refers.

TYPE.—Single-seat Naval Strike Aircraft.

WINGS.—Low-wing cantilever monoplane. Wing section 65.2.214-212 modified. Aspect ratio 5.5. Chord 10 ft. 6 in. (3.20 m.) at root, 8.15 ft. (2.48 m.) mean. Dihedral —1° inner wing, +6° outer wing. All-metal flush-riveted stressed-skin structure. Centre-section built integral with fuselage. Outer wings fold upward hydraulically. Ailerons of sealed forward-balance type with spring tabs and electrically-controlled trimmer-tab. Hydraulically-operated Youngman flaps on inner wing, and dive-brakes on outer wing sections. Total area of ailerons 37.4 sq. ft. (3.47 m.²). Total area of flaps 57.3 sq. ft. (5.32 m.²). Gross wing area 355 sq. ft. (32.97 m.²).



The Westland Wyvern S. Mk. 4 Strike Fighter (Armstrong Siddeley Python 3 engine).

FUSELAGE.—All-metal flush rivetted stressed-skin structure aft of engine mounting attachment bulkhead. Rear section detachable at a transport joint, approximately mid-way between wing trailing-edge and tailplane.

TAIL UNIT.—Cantilever monoplane type. All-metal flush rivetted stressed-skin structure of generally similar construction to wings. Fin detachable at base. Tailplane has 10° dihedral and is separately attached to the fuselage at base of fin. Elevators have sealed-type forward balance with small tiphorn balances; spring-tab on port elevator, mechanically-operated trim-tab on starboard. Rudder has sealed forward balance with small inset horn, and electrically-controlled trim-tab. Total vertical area 51 sq. ft. (4.74 m.²). Total horizontal area 101 sq. ft. (10.38 m.²).

LANDING GEAR.—Fully-retractable tail-wheel type. Hydraulic retraction. Dowty liquid-spring shock-absorbers. Dunlop wheels and pneumatic bag-type brakes. Sting-type arrester hook flush in fuselage under-surface abaft tail-wheel. Track 14 ft. 5 in. (4.39 m.). Wheelbase 23 ft. 3 in. (7.09 m.).

POWER PLANT.—One Armstrong-Siddeley Python 3 axial-flow turboprop engine with a take-off rating of 3,670 s.h.p. plus 1,180 lb. (536 kg.) jet thrust. Rotol eight-bladed contra-rotating airscrew.

ACCOMMODATION.—Pilot's cockpit above the wing centre-section to give an extensive view for deck landing and all Naval operations. The windscreen has flat sides and curved central panel. Jettisonable hood and a cartridge-operated ejector seat.

ARMAMENT.—Four 20 mm. cannon, two in each wing, one inboard and one outboard of wing fold. External stores may include torpedo, bombs, mines or depth charges beneath fuselage, rockets under wings, etc.

DIMENSIONS.—
Span 44 ft. (13.42 m.).
Length 42 ft. 3 in. 12.88 m.).
Height 15 ft. 9 in. (4.80 m.).

WEIGHTS AND PERFORMANCE.—
No data available.

THE WESTLAND SIKORSKY S-51 HELICOPTER.

British military name: Dragonfly.

Westland acquired the licence to build the Sikorsky S-51 helicopter in 1947. Since then Westland-built S-51's have been supplied to B.E.A., Sabena and other airlines, as well as to various industrial concerns for agricultural spraying and dusting both in Europe and the tropics.

Westland have also developed a special military version with modified cabin, large radio bay and other additions to meet the requirements of the R.A.F. and Royal Navy. The military S-51 is named Dragonfly and the following marks are in service.

Dragonfly H.R. Mk. 1. Alvis Leonides 50 engine. Fully-equipped for Air/Sea Rescue and special photography. In service with the Royal Navy.

Dragonfly H.C. Mk. 2. Alvis Leonides 24 engine. Primarily equipped for casualty evacuation. Two enclosed stretcher cases may be carried, one on each side of fuselage, with alternative cabin accommodation for sitting casualties. In service with R.A.F.

Dragonfly H.R. Mk. 3. Alvis Leonides 50 engine. All-metal main rotor blades and hydraulic servo control mechanism. In service with Royal Navy.

Dragonfly H.C. Mk. 4. Alvis Leonides 50 engine. Improved H.C. Mk. 2 with all-metal main rotor blades and hydraulic servo control mechanism. In service with R.A.F.

The description which follows applies primarily to the latest version of the commercial S-51.

TYPE.—Four-seat Single-rotor Helicopter.

ROTORS.—Three-blade main rotor and three-blade anti-torque tail rotor. Free-flapping blades with hinges on centre-line of rotor. Hydraulic servo control mechanism. Main rotor blades of all-metal construction. Main rotor blade area 30.8 sq. ft. (2.86 m.²) each. Disc area of main rotor 1,885 sq. ft. (175.21 m.²), of tail rotor 55.6 sq. ft. (5.16 m.²). Main rotor drive by shaft through double epicyclic reduction gear. Main rotor/engine r.p.m. ratio 1 : 11.88. Anti-torque rotor/engine r.p.m. ratio 1 : 1.80.

FUSELAGE.—Semi-monocoque light alloy cabin and tail cone, tubular steel centre section.

LANDING GEAR.—Three-wheel type with swivelling nose wheel. Turner oleo-pneumatic shock-absorber legs. Dunlop wheels. Track: 12 ft. (3.66 m.). Wheelbase: 10 ft. 1 in. (3.08 m.).

POWER PLANT.—One 550 h.p. Alvis Leonides 521/1 (or 450 h.p. Pratt & Whitney R-985-B4) radial engine mounted horizontally in fuselage centre-section and driving main rotor through vertical shaft and double epicyclic reduction gearing. Two 41.5 Imp. gallon (188 litre) fuel tanks in fuselage centre section.

ACCOMMODATION.—Enclosed cabin seating four, pilot in front and three passengers abreast at rear of cabin. Dual control with pilot and co-pilot in tandem possible. Cabin easily adapted to freight carrying. Sliding doors on each side.

DIMENSIONS.—
Main rotor diameter 49 ft. (14.94 m.).
Overall length 57 ft. 6½ in. (17.54 m.).
Length of fuselage 41 ft. 1¾ in. (12.53 m.).



The Westland Sikorsky Dragonfly H.C. Mk. 2 Casualty Evacuation Helicopter (550 h.p. Alvis Leonides 24 engine).



The Westland-Sikorsky Dragonfly H.R. Mk. 1 Naval Helicopter (550 h.p. Alvis Leonides 50 engine).

Overall width 41 ft. 9 in. (12.73 m.).
Height to top of rotor pylon 12 ft. 11⅜ in. (3.93 m.).
Diameter of anti-torque rotor 8 ft. 5 in. (2.56 m.).

WEIGHTS. –
Weight empty 4,300 lb. (1,952 kg.).
Useful load 530 lb. (240 kg.).
Commercial load 1,470 lb. (667 kg.).
Normal loaded weight 5,700 lb. (2,587 kg.).
Max. loaded weight 5,870 lb. (2,660 kg.).

PERFORMANCE (540 h.p. Alvis Leonides engine and 5,700 lb. = 2,587 kg. A.U.W.).—
Max. speed at S/L. 103 m.p.h. (164.8 km.h.).
Cruising speed 85 m.p.h. (136 km.h.).
Hovering ceiling (without ground effect) 6,000 ft. (1,830 m.).
Hovering ceiling (in ground effect) 8,000 ft. (2,440 m.).
Service ceiling 14,000 ft. (4,270 m.).
Still air range 300 miles (480 km.) with fuel reserve for 20 min. further flight.

THE WESTLAND SIKORSKY S-55.

TYPE.—Military or civil multi-purpose Helicopter.

ROTOR.—Three-blade main rotor, two-blade anti-torque tail rotor. Main rotor blades on offset flapping hinges with hydraulic damping about drag hinges. Swash-plate control mechanism. All-metal blades have extruded spars and light alloy skinned trailing-edges. Main rotor blade area 32.5 sq. ft. (3.02 m.²) each. Disc area of main rotor 2,206 sq. ft. (204.93 m.²). Disc area of tail rotor 61 sq. ft. (5.66 m.²). Main rotor drive by inclined shaft through helical bevel gears and double epicyclic reduction. Main rotor/engine r.p.m. ratio 11.3148 : 1. Anti-torque rotor/engine r.p.m. ratio 1.62 : 1.

FUSELAGE.—Rectangular light alloy semi-monocoque structure with metal cone extension carrying tail rotor.

LANDING GEAR.—Four-wheel type, with forward pair of wheels castoring and rear pair taking main landing and brake loads. Turner air-oil shock struts. Dunlop wheels and brakes. Track 11 ft. (3.35 m.) main wheels, 4 ft. 6 in. (1.37 m.) nose wheels. Wheelbase 10 ft. 4 in. (3.15 m.).

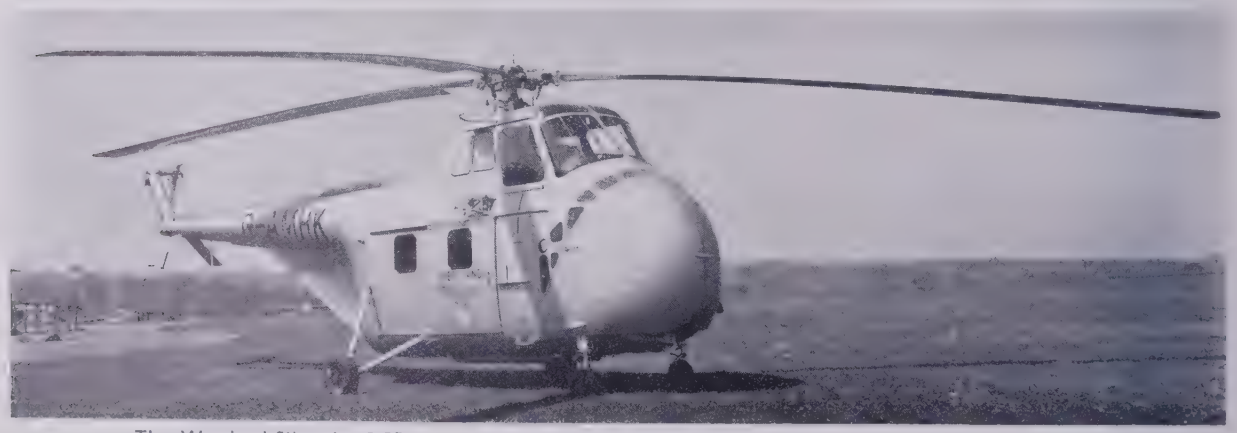
POWER PLANT.—One 600 h.p. Pratt & Whitney R-1340-40 Wasp radial air-cooled engine on inclined axis in nose compartment and driving main rotor gear-box by sloping shaft. Nose doors give access to engine installation. Fuel tanks (150 Imp. gallons = 680 litres) under cabin floor.

ACCOMMODATION.—Cockpit seating two side-by-side with dual controls in nose above engine. Main cabin 6 ft. × 10 ft. × 5 ft. 6 in. (1.82 m. × 3.05 m. × 1.67 m.) directly under rotor head can accommodate wide variety of loads, including 10 fully-armed troops, six stretchers, etc. Loading door 4 ft. × 4 ft. (1.22 m. × 1.22 m.) on starboard side. Power operated pilot-controlled hydraulic hoist for lifting loads while hovering. Cargo capacity 340 cub. ft. (9.6 m.³).

DIMENSIONS.—
Main rotor diameter 53 ft. (16.1 m.).
Overall length 62 ft. 1½ in. (18.95 m.).
Length of fuselage 41 ft. 8½ in. (12.71 m.).
Overall width 45 ft. 9½ in. (13.94 m.).
Height to top of rotor pylon 13 ft. 3 in. (4.04 m.).
Diameter of ante-torque rotor 8 ft. 11 in. (2.74 m.).

WEIGHTS.—
Weight empty 4,780 lb. (2,170 kg.).
Disposable load 2,720 lb. (1,235 kg.).
Normal loaded weight 7,500 lb. (3,405 kg.).

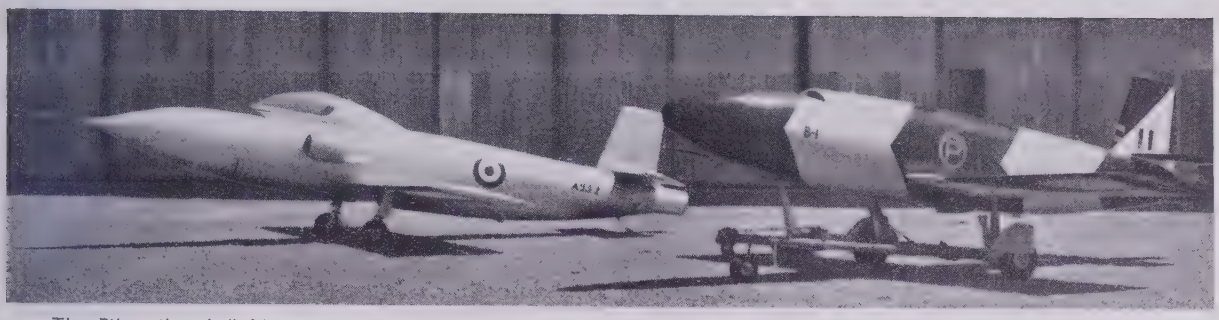
PERFORMANCE (at 6,800 lb. = 3,080 kg.).—
Max. speed at sea level 110 m.p.h. (177 km.h.).
Cruising speed 86 m.p.h. (138 km.h.).
Best rate of climb at S/L. 1,130 ft./min. (345 m./min.).
Vertical rate of climb at S/L. 400 ft./min. (122 m./min.).
Hovering ceiling (in ground effect) 3,300 ft. (1,006 m.).
Hovering ceiling (without ground effect) 5,000 ft. (1,525 m.).
Service ceiling 12,000 ft. (3,660 m.).
Still air range 300 miles (480 km.) with fuel reserve for 20 minutes further flight.



The Westland-Sikorsky S-55 Multi-purpose Helicopter (600 h.p. Pratt & Whitney R-1340 engine).

AUSTRALIA

GOVERNMENT FACTORIES



The Pika piloted (left) and Jindivik Mk. 1 pilotless Target aircraft designed and built by the Government Aircraft Factory in Melbourne.

DIVISION OF AIRCRAFT PRODUCTION, DEPARTMENT OF DEFENCE PRODUCTION.

Head Office : 8th Floor, 339 Swanston Street, Melbourne.

Director of Aircraft Production : V. F. Letcher.

Aircraft Factories : Fishermen's Bend and Essendon, Melbourne.

General Manager : M. B. Woodfull.

Maintenance Branch : Fairfield, Melbourne and Parafield, South Australia.

Manager : M. A. W. Forestier.

Engine Factory : Lidcombe, New South Wales.

Managed by the Commonwealth Aircraft Corporation Pty. Ltd.

Propeller Annexe, Alexandria, New South Wales.

Managed by the de Havilland Aircraft Pty. Ltd.

Heavy Forge Annexe.

Managed by the Australian Aluminium Company Pty. Ltd.

Production of the English Electric Canberra twin-jet bomber, powered with Rolls-Royce Avon engines, followed the completion during 1953 of the last of the 73 Avro Lincoln four-engined heavy bombers at the Australian Government Aircraft Factories. The first Australian-built Canberra made its first flight on May 29, 1953.

The Lincoln had been in production in Australia since the end of the war. The first Australian Lincoln flew on March 17, 1946, twenty-three months after the first drawings had been received from England. The first five aircraft were assembled partially from parts imported from England but, thereafter, practically the entire airframe has been manufactured in Australia. The first fifty aircraft were fitted with Merlin 85 engines but these later gave place to Merlin 102 engines built in Australia at the Aero-engine Factory at Lidcombe, N.S.W. The rate of production of the Lincoln was kept low so as to maintain in existence the nucleus of aircraft manufacturing capacity capable of undertaking the production of any type of aircraft required by the R.A.A.F.

The last series of Lincolns built had the front fuselage lengthened by six feet to accommodate two extra crew members and additional equipment to make the aircraft more effective in its new long-range general reconnaissance and anti-submarine roles.

AUSTRALIA'S TARGET AIRCRAFT.

Early in 1948 a series of meetings was held in London between representatives of the British Ministry of Supply and the Australian Department of Supply and Development to draft a specification covering the design and manufacture of a high-speed pilotless target aircraft for use in the guided missile development programme. This was issued in March, 1948 as Ministry of Supply Specification No. E7/48 and design work on the project began shortly after at the Government Aircraft Factories in Melbourne.

In order to reduce the overall development period, it was considered desirable that a piloted version should be designed concurrently with the pilotless to provide a human check on general flight characteristics and functioning of the remote controlling equipment. At the same time it was agreed that both versions should be fitted with the Armstrong Siddeley Adder engine, a pure jet development of the Mamba turboprop engine, giving a maximum thrust slightly in excess of 1,000 lb. (454 kg.).

Before proceeding with descriptions of both types, it may be pertinent to note that the piloted variant, known as the Pika, was the first Australian-designed jet aircraft to take the air, while the pilotless version, the Jindivik, is almost certainly the first remotely-controlled jet aircraft to be built in the British Commonwealth.

THE PIKA PILOTED VERSION.

The piloted version, the first prototype of which made its initial flight in October, 1950, was originally locally known as Project C, but has now been named Pika (an aboriginal word meaning "flier"). It differs little from the pilotless aircraft, either in overall dimensions or in basic layout or planform. Nor is its all-up weight very much greater as, by reducing its fuel capacity and omitting some special items of equipment required only on target trials, the additional weight associated with the pilot has been almost counterbalanced.

There are, however, three major differences between the versions. First, of course, there is the cockpit complete with all the necessary flying and engine instruments, controls, warning lights,



The last version of the Australian-built Lincoln with lengthened nose which is in service in the R.A.A.F. on long-range oversea reconnaissance and anti-submarine duties.

oxygen system, etc. The un-manned aircraft requires no such facilities. Second, the air for the engine is taken in through [illegible] side of the fuselage instead of through the top submerged entry used on the pilotless model.

The third big difference lies in the [illegible]. While a skid is fitted on the pilotless version, the piloted aircraft has what is possibly the smallest retractable undercarriage ever produced. The [illegible], containing conventional oleo-pneumatic struts and equipped with [illegible], high-pressure tyres of less than 13 in. (33 cm.) diameter and hydraulic brakes, are retracted into the wing fuselage junctions. The pneumatic retracting system consists of a fixed-capacity high-pressure supply (2,000 lb. per sq. in. = 140 kg. cm.^{2}) capable of providing at least four complete cycles of operation on one charge. The tail skid, with a small oleo-pneumatic strut, is not retractable.

By March, 1953, the Pika had done a considerable amount of flying and its use as a useful test vehicle for checking equipment and developing techniques has been of great value in the overall development programme.

THE JINDIVIK Mk. 1 PILOTLESS VERSION.

Known initially as Project B and now bearing the name Jindivik, also of [illegible] origin, several Mk. 1 pilotless aircraft have been completed and trials have been proceeding satisfactorily since the initial flight in August, 1952.

While a high degree of aerodynamic [illegible] was required to achieve the necessary performance, the overriding considerations in the design of the Jindivik were cheapness and simplicity of construction and ease of assembly and maintenance. These conflicting factors have resulted in more compromises than would be normal on a piloted aircraft, but on the whole the aerodynamics have been straightforward.

[illegible]

Wing section NACA 64 Series with constant [illegible]. Aspect [illegible] and 70% of [illegible] pressed ribs [illegible] by vee-[illegible]. Chordwise skin joints and most forward spanwise joints on upper and lower surfaces at 50% of chord. Ailerons and flaps of circular-nosed type with sealed gap, their chord being 20% of wing chord. Ailerons operated by one of the auto-pilot servomotors, flaps by an electro-pneumatic system. Small air brake flaps of type used on the Vampire provided.



The Pika pilotless Target Aircraft (Armstrong Siddeley Adder turbojet engine).

Fuselage.—Of light alloy, in three detachable sections. Nose section carries the accumulators and automatic pilot gyro units, and is hinged to allow access to control equipment. Centre fuselage houses at its front end the radio control and telemetry equipments in a removable crate. Then follows a large bay for any special unit required for target trials, and the main fuel tank bay which contains a light crash-proof rubber bag through which the air intake passes. Rear fuselage carries the engine. Two small fuel tanks located under engine and behind these are the servo motors for rudder and elevators.

Tail Unit.—Cantilever monoplane of all-metal construction. All surfaces of NACA 64 Series aerofoil section with maximum thickness/chord ratio of 8%. Movable surfaces of plain circular-nosed type with small unshielded horns enclosing mass balances.

Landing Gear.—Retractable central skid type. Skid on parallel linkage with oleo-pneumatic shock strut. As skid is not used in take-off it is normally held in retracted position by a copper shear pin, with all air exhausted from shock-strut. On receipt of "undercarriage down" signal from ground control station, air is released from a high-pressure supply bottle to strut through reducing valve, up-lock pin is sheared and skid fully lowered. Interconnection between skid mechanism and flaps to prevent latter from contacting ground when they are in landing position and the skid is fully compressed. To allow use of flap for take-off, a spring-loaded strut is provided in the inter-connecting link, the flaps being manually moved to desired setting before take-off and automatically returned to flying position at a speed some 40% above the stall.

Power Plant.—One Armstrong Siddeley Adder ASa.1 turbojet engine in rear fuselage, front frame of which provides a sealing bulkhead. Engine shrouded to reduce heat radiation and cooling air flow is induced through rear fuselage by extractor fairing over the jet-exit. Air intake of NACA submerged type on top of body forward. Fuel system pressurised from engine compressor casing through reducing valve, fuel being pumped from tanks in rear fuselage to the main tank and thence to engines. Throttle operated by electric actuator and fuel shut-off valve by solenoid control. Starting system is normal except that the panel controlling the timed sequence of operations is carried on a van and plugged into a point on the aircraft when required.

Electrical System.—In both piloted and pilotless versions main power supply is from a standard 24 volt D.C. engine-driven generator feeding comparatively low capacity accumulator with voltage regulation. All main circuits protected by self-resetting thermal overload switches.

Remote-Control Equipment.—Control can be achieved from either a ground or air-borne controlling station. Equipment consists briefly of a radio control receiver, units for interpreting external signals and applying them to control the aircraft, automatic pilot, and a telemetry transmitter for passing essential control information back to ground. In addition, a transponder is fitted to boost the radar response of the aircraft to increase the range over which it can be tracked. Notch aerials in fin leading-edge for radio receiver and telemetry transmitter.

Take-off Trolley.—Tubular framework with tricycle wheel configuration. Framework carries three arms on which aircraft is mounted, two under the wings and one under the front fuselage, together with a tie-rod connected at one end to a release hook on the aircraft and at the other end to brake cylinder on the trolley. When release is made, which is done automatically at a predetermined take-off speed, the arms collapse (with spring assistance) leaving the aircraft to fly off. At the same time brake cylinder applies pressure to the brakes on the rear wheels of the trolley. To keep the aircraft running straight during taxying, etc. the nose wheel is fitted with a servo steering mechanism monitored by a directional gyro.

Dimensions.—
Span 19 ft. (5.79 m.).
Length overall 23 ft. 3¾ in. (7.11 m.).
Height (static on skid to top of fin) 6 ft. 3½ in. (1.92 m.).

Weights and Performance.—
No data available.



The Jindivik Mk. 1 pilotless Target aircraft leaving the take-off trolley.



The Jindivik Mk. 1 resting on its skid at the end of a landing run.

THE JINDIVIK Mk. 2 PILOTLESS VERSION.

The Jindivik Mk. 2 will be powered by an Armstrong Siddeley Viper short-life turbojet. This version is similar in layout to the Mk. 1 but the aerodynamically-controlled features have been revised to permit full advantage to be taken of the greater thrust provided by the Viper engine. At the same time, the structure has been considerably simplified to reduce production man-hours to as low a figure as possible.

Wings.—Mid-wing cantilever monoplane. Wing section NACA 64 Series with constant thickness-chord ratio of 6% and cambered to C/L. of 0.1. Aspect ratio 4.75. Heavy

four-spar box structure between 20% and 60% of chord from aircraft C/L. to wing-tip, which is closed by cast sealing rib. No rivets used, the whole box being bonded with a thermo-setting adhesive to form an integral fuel tank. Light skinned, paper honeycomb-filled fairing completes the leading-edge. Trailing-edge is of light-skinned, two-spar and multi-rib construction, and has along its rear edge a piano hinge to carry flap and aileron. Ailerons and flaps are of fluted and folded skin construction with continuous piano hinge bonded in position. No air brake fitted, landing flap being used in its take-off position. Ailerons operated by electric servo-motor, flaps by electro-pneumatic system.

FUSELAGE.—Of light alloy in three detachable sections. Nose section carries automatic pilot, radio control and telemetry equipment on three removable trays. Top half lifts off for access. Centre fuselage has at its front end a large bay for special equipment required for target trials and the main fuel tank bay as in Jindivik Mk. 1. Rear fuselage carries the engine and jet-pipe.

TAIL UNIT.—Cantilever monoplane type. Tailplane and fin are of monospar light skin. Honeycomb-filled construction bonded with a thermo-setting adhesive. No rudder. Elevators are piano-hinged and of fluted and folded light skin construction. Actuation by electric servo-motor mounted under tailplane.

LANDING GEAR.—As for Jindivik Mk. 1, but of simplified unit construction and with no linkage between rear link and flap.

POWER PLANT.—One Armstrong Siddeley Viper ASV.2 short-life turbojet engine. Installation and fuel system as for Jindivik Mk. 1, except that in Mk. 2 secondary fuel tanks are in wings instead of in rear fuselage. Compressed air is used for engine starting, an air blast being fed into turbine blades through casing.

ELECTRICAL SYSTEM, REMOTE-CONTROL EQUIPMENT AND TAKE-OFF TROLLEY.—Same as for Jindivik Mk. 1.

DIMENSIONS.—
Same as for Jindivik Mk. 1.

COMMONWEALTH



The Commonwealth CA-27 Sabre Single-seat Fighter (Rolls-Royce Avon turbojet engine).

COMMONWEALTH AIRCRAFT CORPORATION PTY., LTD.

HEAD OFFICE AND WORKS: LORIMER STREET, PORT MELBOURNE, VICTORIA.

Directors: L. Darling (Chairman), Essington Lewis, C.H., K. G. Begg, M. L. Baillieu, Lieut. Gen. Sir Leslie Morshead, K.C.B., K.B.E., C.M.G., D.S.O., E.D., Sir Alexander Stewart, L. J. Wackett, D.F.C., A.F.C., B.Sc. (Manager), A. G. Brown (Secretary).

The Commonwealth Aircraft Corporation, Pty., Ltd., was formed in 1936 under a scheme propounded by the Australian Government for the establishment of an aircraft industry to make Australia independent of outside supplies.

The Commonwealth Aircraft Corpn. has an authorised capital of £1,000,000. The shareholders include the Broken Hill Pty., Co.; Broken Hill Associated Smelters Pty., and its associate, the Electrolytic Zinc Co. of Australia; Imperial Chemical Industries of Australia and New Zealand; the Orient Steam Navigation Co.; and Rolls-Royce, Ltd.

The latest product of the Corporation is the CA-22 three-seat basic trainer, the first prototype of which flew in 1950 for the first time. The CA-22 has been named Winjeel (from an aboriginal word meaning Eagle). The first production batch of Winjeels are fitted with the 445 h.p. Pratt & Whitney Wasp-Junior engine, but later models will be powered by a new seven-cylinder radial engine known as the Cicada which has been developed by the Engine Division of the Commonwealth Aircraft Corporation.

Commonwealth are responsible for the production, under licence from North American Aviation, Inc., of the Sabre swept-wing fighter for the Royal Australian Air Force. The Australian-built Sabre has been designated the CA-27 and is powered by the Rolls-Royce Avon turbojet engine, which is also being built at the Corporation's works at Fishermen's Bend. The first flight of the prototype Avon-engined Sabre took place on August 3, 1953.

Details of the activities of the Engine Division of the Commonwealth Aircraft Corporation will be found in the appropriate engine sections of this Volume.

THE COMMONWEALTH CA-27 SABRE.

The Commonwealth Sabre, the prototype of which flew for the first time on August 3, 1953, is based on the North American F-86F and incorporates a considerable amount of local major re-design to allow it to be powered by the Rolls-Royce Avon engine of greater power and lighter installed weight. With the Avon consuming 25 per cent. more air than the J47, calling for a much larger air inlet duct; and its lighter weight, necessitating its re-positioning further aft in order to preserve the original C.G. positions; structural re-design and the re-arrangement of internal equipment has resulted in only about 40 per cent. of the original fuselage structure being retained.

A heavier cannon armament has also been installed, and provision is made for the fitting of under-wing rockets and bombs.

TYPE.—Single-seat Fighter.

WINGS.—Low-wing cantilever monoplane with 35° sweepback. Thin laminar-flow wing section. All-metal structure of sandwich type construction in which the structural material is laminated between the inner and outer tapered skins. No ribs in inboard halves of wing panels and skin is milled from ¼" material at roots. Fuel cells in centre-section and outboard wings. Auto slots on leading-edge. Slotted flaps. Gross wing area 274 sq. ft. (25.4 m.²). Irreversible power-operated aileron control system.

FUSELAGE.—Oval section all-metal structure with flush-riveted stressed skin. Speed brakes near rear of fuselage.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. All surfaces have 35° sweep-back. 10° dihedral tailplane. Tailplane and elevators controllable and linked for co-ordinated movement. Pitch control is irreversible and power-operated. Artificial sensing system to give pilot a representative feel in absence of air loads.

LANDING GEAR.—Retractable tricycle type with steerable nose-wheel. Hydraulic retraction. Cleveland air-oil shock struts. Extra high-pressure tyres. Bendix multiple-disc hydraulic brake in cast magnesium main wheels. Track 8 ft. 3 in. (2.5 m.).

POWER PLANT.—One Rolls-Royce Avon axial-flow turbojet with straight ram air entry in nose of fuselage. Nose entry lipped above to maintain adequate air-flow in nose-up position. Main fuel tanks in fuselage. External long-range drop tanks may be carried under wings outboard of landing-gear.

ACCOMMODATION.—Pressurised pilot's cockpit with sliding bubble canopy. Pilot ejection seat.

ARMAMENT AND EQUIPMENT.—No details available.

DIMENSIONS.—
Span 37 ft. 1 in. (11.3 m.).
Length 37 ft. 6 in. (11.45 m.).
Height 14 ft. (4.27 m.).

WEIGHTS AND PERFORMANCE.—No details available.

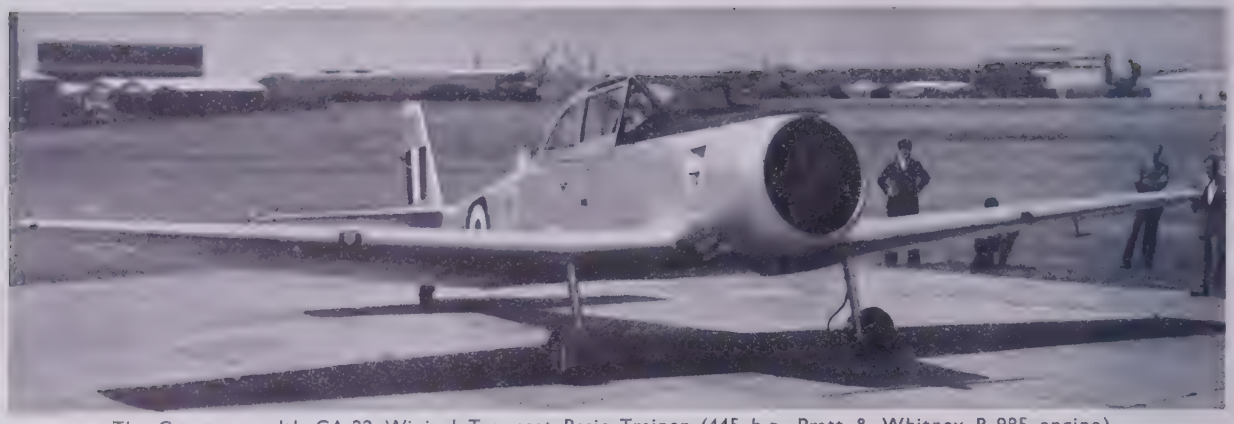
THE COMMONWEALTH CA-22 WINJEEL.

TYPE.—Three-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. Two-spar aluminium-alloy structure. All-metal electrically-operated trailing-edge flaps between ailerons, including section beneath fuselage. Ailerons have metal frames and fabric covering. Gross wing area 250 sq. ft. (23.22 m.²).

FUSELAGE.—Aluminium-alloy semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Metal frames with metal-covered fixed



The Commonwealth CA-22 Winjeel Two-seat Basic Trainer (445 h.p. Pratt & Whitney R-985 engine).

surfaces and fabric-covered rudder and elevators. Horizontal tail area (gross) 18.17 sq. ft. (4.67 m.²). Vertical tail area (gross) 23.05 sq. ft. (2.14 m.²).

LANDING GEAR.—Fixed tail-wheel type. Cantilever long-stroke oleo-pneumatic shock-absorber struts. Hydraulic wheel-brakes. Track 10 ft. (3.05 m.).

POWER PLANT.—One 445 h.p. Pratt & Whitney R-985-SB Wasp Junior nine-cylinder radial air-cooled engine on welded steel-tube mounting. Mounting attached to fireproof bulkhead by four bolts and quickly removable. Cowling in four opening panels hinged at the firewall for complete engine accessibility. Two-blade controllable-pitch airscrew. Main fuel tank (65 Imp. gallons = 296 litres) between spars in centre-section. Auxiliary tank (30 Imp. gallons = 136.5 litres) may be carried beneath centre-section.

ACCOMMODATION.—Enclosed cockpit seats three, two side-by-side with dual controls in front, plus third seat for additional pupil aft. Radio compartment beside rear seat. Sliding canopy may be jettisoned in emergency. Amber screening for blind flying training.

DIMENSIONS.—
Span 38 ft. 9 in. (11.81 m.).
Length 28 ft. 10½ in. (8.80 m.).
Height 8 ft. 3 in. (2.52 m.).

WEIGHT AND LOADINGS.—
Weight loaded 3,997 lb. (1,815 kg.).
Wing loading 16 lb./sq. ft. (78 kg./m.²).
Power loading 8.9 lb./h.p. (4.04 kg./h.p.).

PERFORMANCE.—
No data available.

DE HAVILLAND



The Australian-built D.H. Vampire Trainer (D.H. Goblin turbojet engine).

DE HAVILLAND AIRCRAFT PROPRIETARY, LTD.

HEAD OFFICE AND WORKS: MILPERRA ROAD, BANKSTOWN, N.S.W.

Directors: A. Murray Jones (Managing), J. J. Byrne, D. H. McLachlan and R. J. Vicars.

The de Havilland Aircraft Pty., Ltd. was formed in Australia in 1927 to act as agents for the de Havilland Aircraft Co., Ltd., to build de Havilland aircraft under licence, to assemble new aircraft and to operate service stations for de Havilland products throughout Australia.

The de Havilland Vampire 30 jet fighter is currently in production at Bankstown. This aircraft, powered with the Australian-built Rolls-Royce Nene engine, has been chosen as a standard Service type by the Royal Australian Air Force.

Also in current production for the R.A.A.F. and Royal Australian Navy is the Vampire Trainer fitted with the de Havilland Goblin engine. Deliveries of this type began in late 1952.

After the war the company decided



The de Havilland DHA.3 Drover Light Transport (three 145 h.p. D.H. Gipsy Major 10 engines).

to undertake the design and development of a replacement for the D.H. Dragon to meet Australian conditions. A number of layouts were investigated and finally a three-engined all-metal monoplane incorporating the well-established structural features of the Dove and a simple non-retracting landing-gear was decided upon.

This aircraft was designated the DHA-3 Drover and production began in 1948 when the Type Approval Certificate was granted. The Drover was designed to fulfil various duties and those now in service include passenger, freighter and ambulance versions.

A number of Drovers have been fitted with Fairey-Reed fixed-pitch metal propellers which offer a more simple installation to operators in undeveloped areas. A prototype Drover with double slotted flaps is also flying and, in conjunction with fixed-pitch propellers, offers considerable improvements in take-off distance and landing speed.

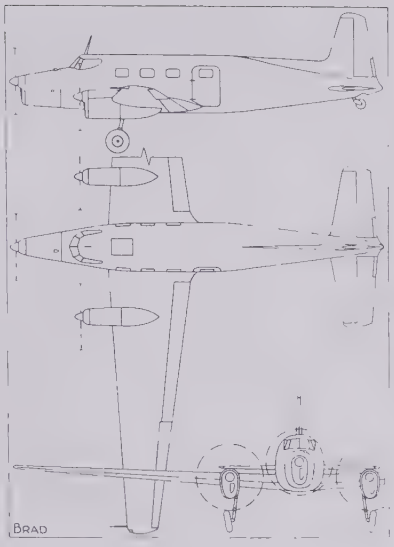
THE DE HAVILLAND DHA-3 DROVER.

TYPE.—Three-engined Commercial monoplane.

WINGS.—Low-wing cantilever monoplane. All-metal structure with stressed skin covering. Single main spar and light rear spar to which flaps and ailerons are hinged. Ailerons and flaps have metal frames and fabric covering. Gross wing area 325 sq. ft. (30.2 m.²).

FUSELAGE.—All-metal stressed-skin structure.

TAIL UNIT.—Cantilever monoplane type. Tailplane and fin are stressed-skin structures, elevators and rudder have metal frames and fabric covering.



The de Havilland DHA-3 Drover.

LANDING GEAR.—Non-retracting tail-wheel type without hydraulic or pneumatic services. Main wheels have rubber-in-compression shock-absorbers. Dunlop single disc type hydraulic differential brakes. Oversize wheels and tyres. Track 14 ft. (4.3 m.). Wheelbase 23 ft. 1 in. (7.0 m.).

POWER PLANT.—Three 145 h.p. D.H. Gipsy Major 10 four-cylinder in-line inverted air-cooled engines, one in the fuselage nose and two in wing nacelles. D.H. variable-pitch airscrew with manual or electric control. No automatic governors fitted. Fuel capacity 90 Imp. gallons (408 litres). Oil capacity 9 Imp. gallons (41 litres).

ACCOMMODATION.—Pilot and from six to eight passengers. In six-passenger version toilet and large baggage compartment are provided. In eight-passenger version toilet is eliminated and baggage space reduced.

DIMENSIONS.—
Span 57 ft. (17.3 m.).
Length 36 ft. 2 in. (11.0 m.).
Height 9 ft. 9 in. (3 m.).

WEIGHTS AND LOADINGS.—
Weight empty 4,100 lb. (1,860 kg.).
Fuel and oil 730 lb. (330 kg.).
Crew 170 lb. (77 kg.).
Payload and radio 1,500 lb. (681 kg.).
Weight loaded 6,500 lb. (2,950 kg.).
Wing loading 20 lb./sq. ft. (97.6 kg./m.²).
Power loading 14.95 lb./h.p. (7.15 kg./h.p.).

PERFORMANCE.—
Cruising speed 140 m.p.h. (225 km.h.) at 5,000 ft. (1,525 m.).
Rate of climb at sea level 800 ft./min. (244 m./min.).
Rate of climb on two engines (T.O. power) 200 ft./min. (61 m./min.).
Take-off to 50 ft. (15.25 m.) in still air 520 yds. (475 m.).
Take-off when one engine fails at safety speed 880 yds. (806 m.).
Landing distance from 50 ft. (15.25 m.) 500 yds. (460 m.).

FAIREY

FAIREY AVIATION COMPANY OF AUSTRALASIA PTY. LTD.

REGISTERED OFFICE: 16, O'CONNELL STREET, SYDNEY, N.S.W.

WORKS: AIRPORT, BANKSTOWN, N.S.W.

POSTAL ADDRESS: P.O. Box 41, BANKSTOWN, N.S.W.

Chairman and Managing Director: Raymond E. Purves.

General Manager: Air Commodore C. B. Wincott, C.B.E., R.A.F. (Retd.).

Secretary: J. R. Sainsbury.

This Company was founded under the name of the Fairey Clyde Aviation Co. Pty. Ltd. early in 1948, by the Fairey Aviation Co. Ltd. of Hayes, Middlesex, England and the Clyde Engineering Co. of Sydney, N.S.W.

In November, 1951 the name was changed to Fairey Aviation Company of Australasia Pty. Ltd. when the Clyde Engineering Company disposed of their holding. Mr. R. E. Purves, the original Chairman and Managing Director, continues in that position.

The Bankstown Works is carrying out overhauls, repairs and reconditioning of Fairey Firefly and Hawker Sea Fury aircraft of the Royal Australian Navy. It is also engaged in experimental work and aircraft conversions.

The Company is approved by both the Royal Australian Navy and the Department of Civil Aviation for design and for all classes of aircraft repair and manufacture.

The Special Projects Division is located at Salisbury, South Australia, with Colonel R. T. Elvish as Manager. This Division is engaged on work in connection with the activities of the Rocket Range at Woomera, South Australia.

CANADA

AVRO



The Avro CF-100 Mk. 4 Two-seat All-weather Fighter (two Avro Orenda turbojet engines).

A. V. ROE CANADA, LTD.

HEAD OFFICE AND WORKS: MALTON, NEAR TORONTO, ONT.

POST OFFICE ADDRESS: BOX 430, TERMINAL "A", TORONTO, ONT.

Chairman: Sir Roy Dobson, K.B.E.

President: Crawford Gordon, Jr.

General Manager (Aircraft Division): F. T. Smye.

Chief Engineer (Aircraft Division): James Floyd.

A. V. Roe Canada, Ltd., a member of the Hawker Siddeley Group, was formed in 1945 when it took over the Malton plant of the Government-owned Victory Aircraft, Ltd.

The Aircraft Division of Avro Canada has designed and built the C.102 Jetliner 40/60-passenger airliner, which was the first jet-driven civil aircraft to fly on the American continent and the second in the entire World; and the CF.100 twin-jet long-range all-weather fighter, the third prototype of which, powered with two Avro Canada Orenda turbojet engines, was the first aircraft of wholly-Canadian design and construction to fly.

The CF.100 has been ordered in quantity by the Canadian Government and production of the airframe and the Orenda engine resulted in the construction of new and enlarged facilities both at Malton and among the many engineering firms which are participating in the combined production programmes.

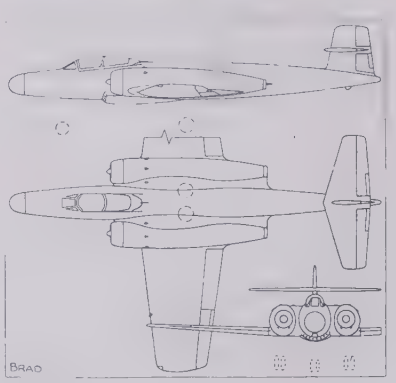
Because of the CF.100 programme further development of the C.102 Jetliner has been abandoned.

The company has also been engaged on the repair and overhaul of Lancasters, and their conversion into bomber-reconnaissance, maritime reconnaissance, photographic-reconnaissance and air/sea rescue aircraft for the R.C.A.F.

In 1946 Avro Canada took over the Government-owned Turbo-Research, Ltd., which was formed in 1944 to undertake research and development of aircraft gas-turbines. The Gas-Turbine Division of Avro Canada has built the Chinook and Orenda turbojet engines. See under "Avro" in Engine Section for details.

THE AVRO CF.100.

The CF.100 two-seat long-range all-weather fighter, which was designed to the requirements of the Royal Canadian Air Force, is the first aircraft to be wholly designed and built in Canada. By exceeding Mach. 1 in a dive from 30,000 ft. (9,150 m.) on December 18, 1952, the CF.100 achieved the distinction of being the first straight-wing combat aircraft to exceed the speed of sound. It is now in large-scale production for the Royal Canadian Air Force.



The Avro CF-100. Mk. 4.

The following are the principal versions of the CF.100:—

Mark 1. Two Rolls-Royce Avon turbojet engines. Two prototypes built. First Mk. 1 flew for the first time on January 19, 1950.

Mark 2. Two Avro Orenda turbojet engines. Pre-production unarmed model. Ten built. First Mk. 2 flew on June 20, 1951. One Mk. 2T with dual controls.

Mark 3. Two Avro Orenda 2 turbojet engines. First production series. Seventy built. Some delivered as Mk. 3T with dual controls. Armament: eight 0.50 in. (12.7 mm.) machine-guns in easily-replaceable ventral tray. First Mk. 3 flew on October 11, 1952. Dimensions same as for Mk. 2.

Mark 4. Two Avro Orenda 9 turbojet engines. Replaces Mk. 3 in production in mid-1953. Longer fuselage and revised nose shape. All-rocket armament carried in retractable pack in underside of fuselage and in wing-tip containers. Latest electronic equipment. Increased performance. Prototype Mk. 4 first flew on October 11, 1952. Span 53 ft. 7 in. (16.3 m.). Length 54 ft. 2 in. (16.5 m.).

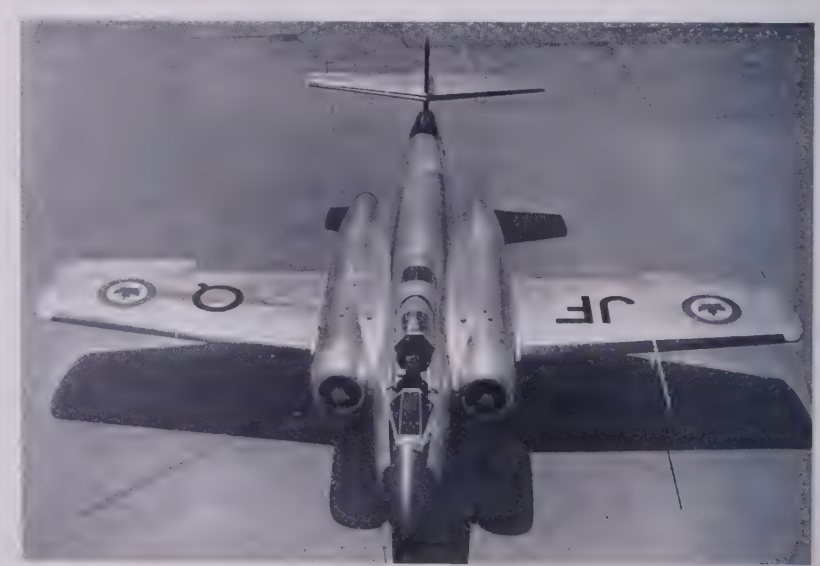
The description below refers in the main to the CF.100 Mk. 2.

TYPE.—Two-seat All-weather Fighter.

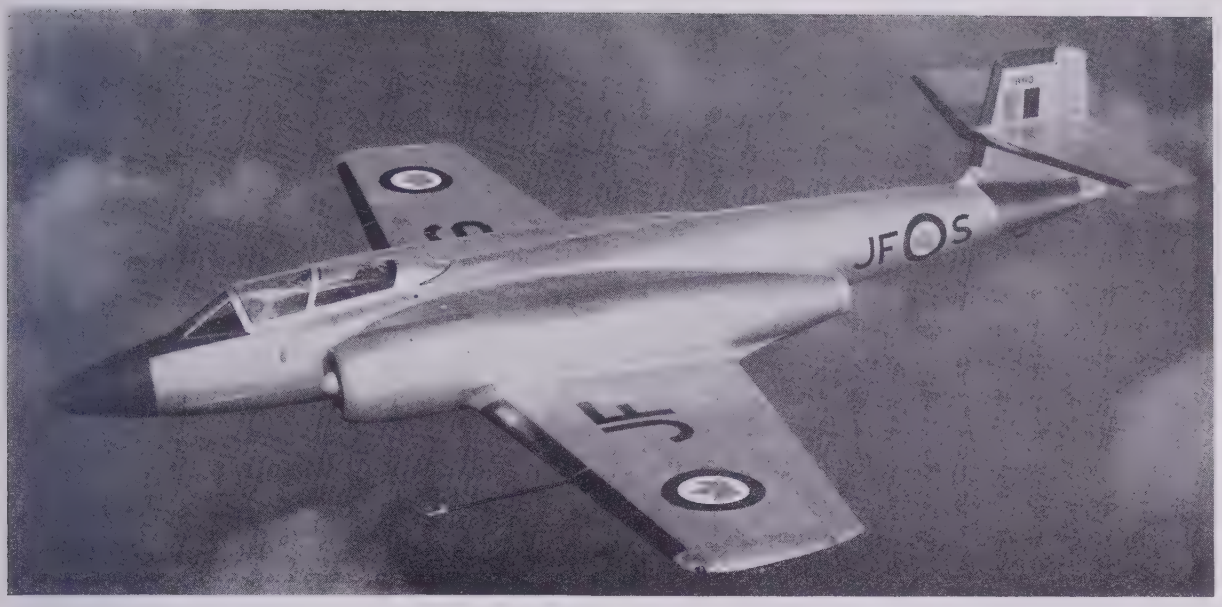
WINGS.—Low-wing cantilever monoplane. Wing section NACA 0010. Aspect ratio 5. Chord at root (transport joint) 12 ft. 2.9 in. (3.73 m.), at tip 6 ft. 11 in. (2.10 m.). Dihedral at datum 3°. Sweepback 25% chord line 1° 50′. All-metal structure. Leading-edge Goodrich de-icer boots. Total aileron area (including tabs) 28.53 sq. ft. (2.65 m.²). Wing flap area (aft of hinge-line) 39.15 sq. ft. (3.64 m.²). Centre section flap area (aft of hinge-line) 26.18 sq. ft. (2.43 m.²). Dive-brake area (total of four) 41.76 sq. ft. (3.88 m.²). Gross wing area 540 sq. ft. (50.16 m.²).

FUSELAGE.—All-metal flush-rivetted monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Tailplane mounted halfway up fin. All-metal structure. Goodrich de-icer boots on fin and tailplane. Area of tailplane 83.76 sq. ft. (7.78 m.²). Total elevator area (aft of hinge-line) 26.50 sq. ft. (2.46 m.²).



The Avro CF-100 Mk. 3 Two-seat All-weather Fighter.



The Avro CF-100 Mk. 2T, a Two-seat Dual-control version of the pre-production Orenda-powered Mk. 2.

Rudder area (aft of hinge-line) 12.22 sq. ft. (1.13 m.²). Fin area 31.53 sq. ft. (2.93 m.²).

LANDING GEAR.—Retractable tricycle type. Dowty liquid-spring shock-absorber struts. Dunlop wheels and Dunlop brakes on main wheels. Track 10 ft. 2 in. (3.10 m.). Wheelbase 16 ft. 9.7 m. (5.11 m.).

POWER PLANT.—Two Avro Canada Orenda Mk. 2 axial-flow turbojet engines (over 6,000 lb.=2,725 kg. s.t. each).

ACCOMMODATION.—Pressurised cockpit seating two in tandem, pilot in front, navigator/radar-operator behind. Sliding jettisonable canopy. Martin Baker Mk. IE ejection seats for both members of crew.

DIMENSIONS.—
Span 52 ft. (15.86 m.).
Span over tip-tanks: 58 ft. 5 in. (17.82 m.).
Length 52 ft. 3.7 in. (15.95 m.).
Height 15 ft. 6.4 in. (4.73 m.).

WEIGHTS AND PERFORMANCE.—
No data available.

CAN-CAR

CANADIAN CAR & FOUNDRY CO., LTD.

HEAD OFFICE: 621, CRAIG STREET WEST, MONTREAL 3, P.Q.

Vice-President and Chairman, Executive Committee: John C. Newman.

Executive Vice-President: E. J. Cosford.

Comptroller: L. A. Bruce.

Treasurer: K. S. Gordon.

Secretary: D. H. Forsyth.

The Canadian Car & Foundry Co. Ltd., the largest manufacturers of railway equipment in the Dominion, entered the Canadian Aircraft Industry by acquiring from the Grumman Aircraft Engineering Corpn., of Bethpage, L.I., N.Y., the licence to construct the Grumman two-seat fighter biplane.

During the late war the Company held contracts with the Canadian, British and American Governments for the manufacture of several types of aircraft and details of its wartime activities have been given in previous issues of this Annual.

C.C.F. also acquired the principal assets of Noorduyn Aviation Ltd., when that company abandoned aircraft manufacture, and it built a number of Norseman single-engined general purposes aircraft for domestic and export requirements. The version built by C.C.F. was the Mk. V, an improved version of the Mk. VI which was built by the Noorduyn company during the War for the U.S.A.F. as the C-64.

In 1953 Can-Car disposed of all its interests in the Norseman to Mr. R. B. C. Noorduyn, whose former company was responsible for the original design and production of this aircraft. Mr. Noorduyn will not build the Norseman, but will supply spare parts, etc. for the large number of aircraft still in service in Canada and elsewhere.

Canadian Car & Foundry Co. Ltd. is not at present developing any new type aircraft. It is, however, engaged in the manufacture, at its Fort William, Ontario, plant, of Harvard Mk. 4 trainers under licence from North American Aviation, Inc. The company has already delivered hundreds of Harvards and accompanying spares to the R.C.A.F. and various N.A.T.O. powers and is continuing deliveries satisfactorily to schedule.

The Can-Car Harvard 4's, are now being fitted with Canadian-built Pratt & Whitney R-1340 Wasp engines. The Canadian Pratt & Whitney company completed its first R-1340 in December, 1952.

In 1953 the Canadian Car and Foundry Co., Ltd. was awarded a U.S.A.F. contract for the manufacture of an unspecified number of Beechcraft T-34A training aircraft, with production scheduled to begin in 1954.

CANADAIR

CANADAIR LIMITED.

HEAD OFFICE AND WORKS: CARTIERVILLE, AIRPORT, MONTREAL.

POSTAL ADDRESS: P.O. Box 6087, MONTREAL.

Chairman of the Board and Managing Director: John Jay Hopkins.

Vice-Chairman of the Board: Lawrence B. Richardson.

President and General Manager: J. Geoffrey Notman.

Vice-President, General Counsel: John E. L. Duquet, Q.C.

Vice-President: Engineering, W. K. Ebel.

Vice-President, Manufacturing: Robert A. Neale.

Vice-President, Sales: Peter H. Redpath.

Assistants to the Chairman: Lambert J. Gross, R. P. Meiklejohn and Roger I. Harris.

Secretary and Treasurer: J. Gordon Barker.

Comptroller and Assistant Secretary: James F. Tooley.

Legal Adviser and Assistant Secretary: John Urwin.

Assistant Comptrollers: Frederick R. Kearns and Theodore C. Pawlett.

Canadair Ltd. was formed in 1944 to take over on a management fee basis the Crown plant on Cartierville Airport which had been built in 1942. In 1947, the company was acquired as a subsidiary by the Electric Boat Company (now General Dynamics Corporation) of New York, one of the World's leading designers and builders of submarines. General Dynamics Corporation recently acquired from the Atlas Corporation 400,000 shares of its holdings of stock of the Consolidated Vultee Aircraft Corporation, which constitutes the largest block of Convair stock in the hands of one holder.

Canadair's first task was the designing and building of a four-engined transport aircraft to the requirements of the Royal Canadian Air Force and Trans-Canada Air Lines. Incorporating certain design features of the DC-4 and DC-6 and powered by four Rolls-Royce Merlin engines, the prototype first flew in July, 1946, following which a total of seventy-one were produced, including a later version, the Canadair Five. Purchasers included Trans-Canada Air Lines, the Royal Canadian Air Force, British Overseas Airways Corporation and Canadian Pacific Air Lines.

Since 1949, Canadair has been engaged almost exclusively in a programme of military aircraft production for the R.C.A.F., R.A.F. and the U.S.A.F. During 1949, quantity production of the Sabre single-seat fighter under licence from North American Aviation, Inc. was begun. By the middle of 1953, nearly 700 Sabres had been built of which some 375 had been delivered to the R.A.F. under Mutual Aid.

Current production, in addition to the Sabre for Canada, England and the United States, includes the Silver Star two-seat jet trainer for the R.C.A.F. Built under a licence agreement from the Lockheed Aircraft Corporation, the Silver Star jet trainer is powered by a Rolls-Royce Nene engine.

Canadair is also engaged in the supply of aircraft replacement parts, routine overhauls, and the conversion of standard passenger aircraft to executive type transports, offering complete overhaul and modification facilities for C-47/DC-3 type aircraft.



The Canadair Sabre Single-seat Fighter (General Electric J47 turbojet engine).

With recent additions and extensions to Canadair's four plants on the Cartierville Airport, the total covered floor area is now 2,500,000 sq. ft. Employment in the Spring of 1953 was approximately 13,500.

THE CANADAIR SABRE.

The Canadair Sabre is built under licence from North American Aircraft Inc. and production began in 1949 for the R.C.A.F. The first Canadair-built Sabre flew on August 9, 1950. This aircraft was based on the F-86A and was known as the Sabre Mk. 1.

All subsequent production Sabres have been to E86E configuration with "flying tail." The Sabre Mk. 2 which has been the standard production model for the last three years is powered by a General Electric J47 engine supplied from the United States.

A Sabre fitted with an Avro Orenda 10 turbojet engine was flying early in 1953 as a prototype for the Sabre Mk. 5 which will follow the Mk. 2 in production later in the year. The production Mk. 5 will have the Orenda 14 engine which will give the Sabre increased performance at higher altitudes.

By the time the Mk. 2 is phased out of production in favour of the Mk. 5 something like 700 Sabres will have been built and supplied to the R.C.A.F., the R.A.F. and the U.S.A.F.

A full description of the Sabre will be found under "North American" (U.S.A.).

THE CANADAIR SILVER STAR.

The Silver Star, which is built under licence from the Lockheed Aircraft Corporation, is the T-33A two-seat trainer version of the Shooting Star with the difference that it is powered by a Rolls-Royce Nene turbojet engine. A contract for 400 is being fulfilled for the R.C.A.F. The first Nene-powered Silver Star flew for the first time in October, 1952.

THE CANADAIR FOUR.

The Canadair Four was designed in its earlier North Star versions, to meet the specifications established by T.C.A. and the R.C.A.F. Incorporating the airframe features of the Douglas DC-4 and DC-6 and powered by four Rolls-Royce Merlin 620 engines, twenty-four were produced for the Royal Canadian Air Force in a military version as the C-54GM, and twenty in a commercial pressurized version as the DC-4M2 for T.C.A.

The Canadair Four, or C-4 was the ultimate commercial development in this series. The fitting of Merlin 626



The first Canadair Silver Star Two-seat Advanced Trainer (Rolls-Royce Nene turbojet engine).



The Canadair DC-4M-2 North Star Airliner (four 1,760 h.p. Rolls-Royce Merlin engines) as supplied to T.C.A. *(Peter Bowers)*



The Canadair Four Airliner (four 1,760 h.p. Rolls-Royce Merlin engines).

engines, rated at 1,760 h.p. for take-off, combined with increased airscrew efficiency, permitted an increase in the all-up gross weight from 73,000 to 2,300 lb. (33,140 to 77,300 kg.), with a corresponding improvement in payload for maximum range and range for maximum payload.

Twenty-six Canadair Fours have been supplied to the British Overseas Airways Corporation and Canadian Pacific Air Lines and are now in regular airline operation.

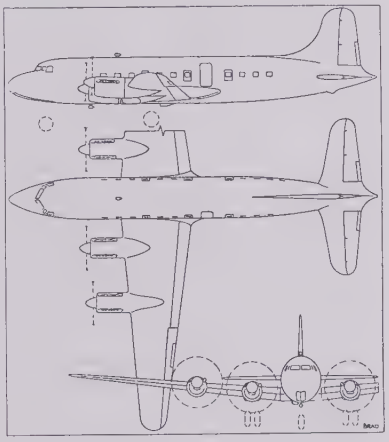
TYPE.—Four-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Aerofoil section NACA 23016/23012. Root incidence 4 degrees. Dihedral 7 degrees. Aspect ratio 9.48 : 1. All-metal structure with flush-riveted Alclad skin. Fuel tanks integral with wing. Flaps are single-slotted type, ailerons are metal-framed and fabric-covered. Gross wing area 1,457 sq. ft. (135.35 m.²).

FUSELAGE.—Semi-monocoque all-metal flush-riveted structure, pressure-sealed to withstand a proof pressure of 5.55 lb./sq. in. (.388 kg./cm.²).

TAIL UNIT.—Cantilever monoplane type. All-metal structure with metal-covered fixed surfaces and fabric-covered rudder and elevators. Total horizontal surface area 324.8 sq. ft. (30.17 m.²), elevator area (aft of hinge line, including tabs) 86.1 sq. ft. (7.99 m.²). Total vertical surface area (including fin extension) 153.6 sq. ft. (14.26 m.²), rudder area (aft of hinge line, including tab) 47.3 sq. ft. (4.38 m.²).

LANDING GEAR.—Retractable tricycle type with dual main wheels and steerable nose wheel. Hydraulic retraction. Hydraulic wheel brakes, with a compressed air system for use in emergency.



The Canadair Four Airliner.

POWER PLANT.—Four Rolls-Royce Merlin 626 twelve-cylinder Vee pressure liquid-cooled engines with two-speed two-stage superchargers, each rated at 1,760 h.p. for take-off at sea level, 1,500 h.p. maximum continuous power at 7,750 ft. (2,360 m.) and 1,420 h.p. maximum continuous power at 18,750 ft. (5,720 m.). Hamilton Standard three-blade constant-speed quick-feathering reversible airscrews 13 ft. 1 in. (3.98 m.) diameter. Maximum fuel capacity 3,226 Imp. gallons (3,871 U.S. gallons = 14,680 litres).

ACCOMMODATION. — Pressurized accommodation for crew and passengers, giving sea-level cabin pressure when flying at 9,000 ft. (2,740 m.) and 8,000 ft. (2,440 m.) cabin pressure when flying at 20,000 ft. (6,100 m.). Cabin has automatic altitude regulation and temperature control. Standard crew consists of two pilots and two cabin attendants. For long-range operation, a radio operator and navigator may be added, together with crew rest area. Passenger compartment has standard daytime seating capacity of 40, which may be increased to 55 for short-range operation, or decreased to 36 to permit full recline, slumber-lounge type accommodation. An alternative interior arrangement with day capacity of 40 is convertible to a 20-passenger sleeper, each sleeper berth being equipped with reading lights, stowages and conditioned and cold air outlets. A galley is located adjacent to the main cabin entrance door.

DIMENSIONS.—
Span 117 ft. 6 in. (35.8 m.).
Length 93 ft. 7½ in. (28.6 m.).
Height 27 ft. 6 5/16 in. (8.4 m.).

WEIGHTS AND LOADINGS. –
Manufacturer's weight empty 46,832 lb. (21,225 kg.).
Max. loaded weight 82,300 lb. (37,300 kg.).
Max. landing weight 70,000 lb. (31,750 kg.).
Wing loading (at max. take-off weight) 56.5 lb./sq. ft. (275 kg./m.²).



The Canadair Five Military Transport (four 2,100 h.p. Pratt & Whitney R-2800 engines).

Power loading (at max. take-off weight) 11.7 lb./h.p. (5.3 kg./h.p.).

PERFORMANCE (70,000 lb. = 31,700 kg. gross weight).

Max. cruising speed (high blower, 1,136 h.p. per engine) 325 m.p.h. (520 km.h.) at 25,200 ft. (7,690 m.).

Max. cruising speed (low blower, 1,165 h.p. per engine) 289 m.p.h. (465 km.h.) at 12,200 ft. (3,720 m.).

Rate of climb at 20,000 ft. (6,100 m.) at max. continuous power 840 ft./min. (256 m./min.).

Service ceiling 29,500 ft. (9,000 m.).

Service ceiling on 3 engines 22,300 ft. (6,800 m.).

CAA take-off field length at sea level, 3,700 ft. (1,130 m.).

PERFORMANCE (at 80,200 lb. 36,400 kg. gross weight).

Max. cruising speed (high blower, 1,136 h.p. per engine) 306 m.p.h. (492 km.h.) at 25,200 ft. (7,690 m.).

Max. cruising speed (low blower, 1,165 h.p. per engine) 278 m.p.h. (447 km.h.) at 12,200 ft. (3,720 m.).

Rate of climb at 20,000 ft. (6,100 m.) at max. continuous power, 570 ft./min. (174 m./min.).

Service ceiling 26,400 ft. (8,050 m.).

Service ceiling on 3 engines 20,000 ft. (6,100 m.).

CAA take-off field length at sea-level 5,200 ft. (1,585 m.).

PERFORMANCE (at 82,300 lb. = 37,150 kg. gross weight). —

Max. cruising speed (high blower, 1,136 h.p. per engine) 302 m.p.h. (485 km.h.) at 25,200 ft. (7,690 m.).

Max. cruising speed (low blower, 1,165 h.p. per engine) 276 m.p.h. (444 km.h.) at 12,200 ft. (3,720 m.).

Rate of climb at 20,000 ft. (6,100 m.) at max. continuous power, 500 ft./min. (153 m./min.).

Service ceiling 25,200 ft. (7,690 m.).

Service ceiling on 3 engines 18,800 ft. (5,740 m.).

CAA take-off field length at sea level 5,650 ft. (1,720 m.).

RANGE.—

Absolute range at 10,000 ft. (3,050 m.) 3,880 miles (6,240 km.) with 3,226 Imp. gallons (14,680 litres).

THE CANADAIR FIVE.

A larger and more powerful version of the North Star—the Canadair Five—was completed during 1950 for the Royal Canadian Air Force. Powered with four Pratt & Whitney R-2800 engines, this aircraft is used by the Air Force both as a long-range crew trainer, and as a private transport for the Canadian Prime Minister and other Government and military officials.

TYPE. Four-engined Airliner.

WINGS and FUSELAGE.—Same as for Canadair Four.

TAIL UNIT. Cantilever monoplane type as for Canadair Four. Total horizontal surface area 365.6 sq. ft. (33.96 m.²), elevator area (aft of hinge line including tabs) 108.9 sq. ft. (10.11 m.²). Total vertical surface area (including fin extension) 159.6 sq. ft. (14.82 m.²), rudder area (aft of hinge line, including tab) 49 sq. ft. (4.55 m.²).

LANDING GEAR. Same as for Canadair Four.

POWER PLANT. Four Pratt & Whitney R-2800-CA15 eighteen-cylinder radial engines, each rated at 2,100 h.p. for take-off at sea level, 1,800 h.p. rated power at 6,000 ft. (1,830 m.) and 1,600 h.p. at 16,000 ft. (4,880 m.). Max. fuel capacity 3,226 Imp. gallons (14,646 litres).

DIMENSIONS.

Span 117 ft. 6 in. (35.8 m.).

Length 93 ft. 7¼ in. (28.6 m.).

Height 29 ft. (8.8 m.).

WEIGHTS AND LOADINGS.—

Manufacturer's weight empty 49,475 lb. (22,461 kg.).

Max. loaded weight 86,000 lb. (39,045 kg.).

Max. landing weight 72,000 lb. (32,690 kg.).

Wing loading (at max. take-off weight) 59.01 lb./sq. ft. (287.9 kg./m.²).

Power loading (at max. take-off weight) 10.24 lb./h.p. (4.64 kg./h.p.).

PERFORMANCE (at 72,000 lb. = 32,690 kg.).—

Max. cruising speed (high blower, 1,175 h.p. per engine) 318 m.p.h. (508.8 km.h.) at 20,400 ft. (6,220 m.).

Max. cruising speed (low blower) 301 m.p.h. (484.6 km.h.) at 11,200 ft. (3,420 m.).

Rate of climb at 20,000 ft. (6,100 m.) at max. rated power 955 ft./min. (291 m./min.).

Service ceiling 29,500 ft. (9,000 m.).

Service ceiling on three engines 24,400 ft. (7,440 m.).

C.A.A. take-off field length at sea level 3,120 ft. (946 m.).

PERFORMANCE (at 86,000 lb. = 39,045 kg.).—

Max. cruising speed (high blower, 1,175 h.p.) 303 m.p.h. (485 km.h.) at 20,400 ft. (6,220 m.).

Max. cruising speed (low blower) 292 m.p.h. (467 km.h.) at 11,200 ft. (3,420 m.).

Rate of climb at 20,000 ft. (6,100 m.) at max. rated power 570 ft./min. (174 m./min.).

Service ceiling 26,200 ft. (7,990 m.).

Service ceiling on three engines 20,000 ft. (6,100 m.).

C.A.A. take-off field length at sea level 4,950 ft. (1,510 m.).

RANGE.—

Absolute range at 10,000 ft. (3,050 m.) with 3,226 Imp. gallons (14,646 litres) 3,985 miles (6,376 km.).

DE HAVILLAND

THE DE HAVILLAND AIRCRAFT OF CANADA, LTD.

HEAD OFFICE AND WORKS: POSTAL STATION "L," TORONTO, ONTARIO.

Managing Director: P. C. Garratt.

Engineering Director: W. D. Hunter.

Sales Director: C. H. Dickins.

Sales Manager: A. F. MacDonald.

Production Manager: W. C. Burlison.

Secretary and Treasurer: G. J. Mickleborough.

The de Havilland Aircraft of Canada Ltd., was established early in 1928 by the de Havilland Aircraft Co., Ltd., as a Canadian constructional plant and service depot for D.H. aircraft.

The authorised capital of the Company is $500,000, of which $306,000 has been issued.

Considerable experimental work has been done in order to produce components and special accessories to meet all Canadian flying conditions.

Since the end of the war the company has flown three aircraft of original design —the DHC-1 Chipmunk two-seat trainer, the DHC-2 Beaver and the DHC-3 Otter, both single-engined cabin monoplanes designed for Canadian "bush" operations.

The Otter, which flew for the first time on December 12, 1951, received its Certificate of Airworthiness both as a landplane and seaplane in October, 1952, and thereupon became the first single-engined aircraft to qualify for approval in accordance with ICAO Category D airworthiness requirements.

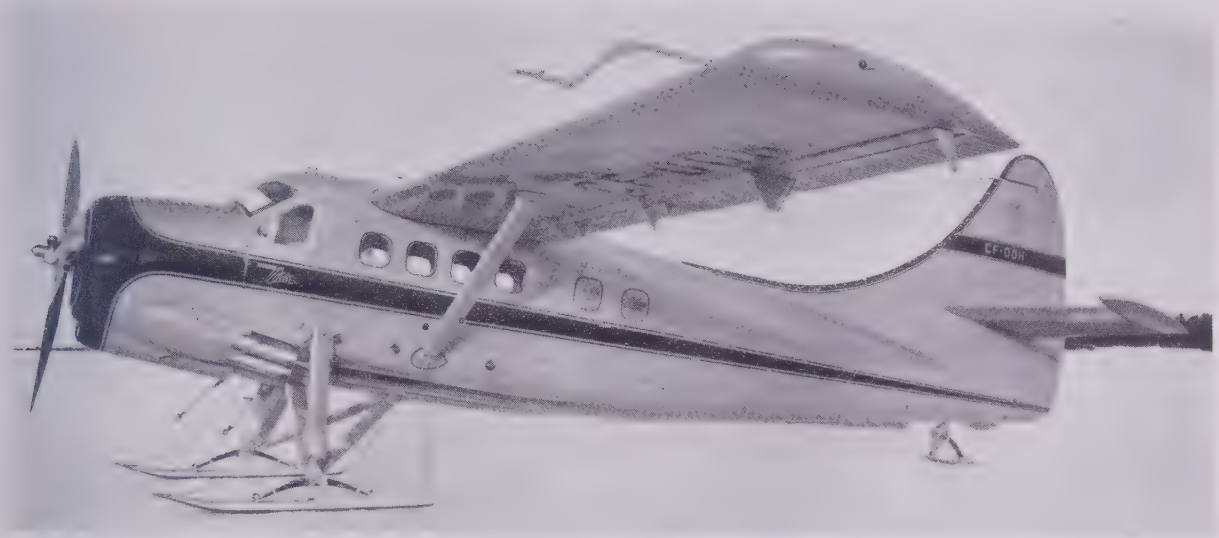
The Otter is now in production and orders are in hand from Provincial and Federal Governments and many civil operators. In March, 1953, the Royal Canadian Air Force received the first of a fleet of six Otters to be delivered in 1953. Seven more will be supplied in the next fiscal year. These aircraft will be assigned to Search and Rescue and Aerial Photography squadrons.

By the end of 1952, more than 500 civil and military Beavers had been built, the majority of the military Beavers being for delivery to the U.S.A.F. and U.S. Army. The Beaver is now in wide use throughout Canada, as well as in the U.S.A., South America, Central and South Africa and New Zealand.

A Mk. 2 version of the Beaver fitted with an Alvis Leonides Series 502/4 engine was flying in the Spring of 1953, but no



The DHC-3 Otter Utility Transport Seaplane (600 h.p. Pratt & Whitney R-1340 engine).



The DHC-3 Otter Utility Transport (600 h.p. Pratt & Whitney R-1340 Wasp engine) equipped as a skiplane.

further particulars were available at the time of writing.

The Chipmunk is no longer in production in Canada, but is still being manufactured in England by the parent de Havilland company (which see).

THE DHC-3 OTTER.

TYPE.—Single-engined nine/fourteen-passenger General Utility Transport.

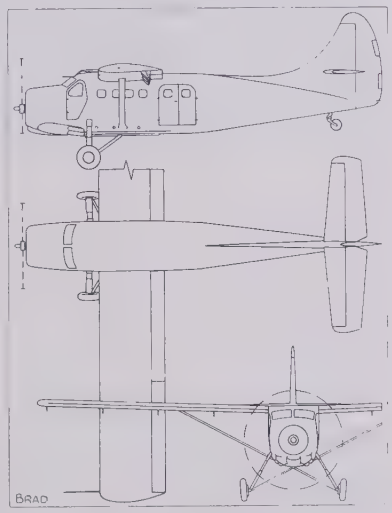
WINGS.—High-wing braced monoplane. D.H. high-lift wing section. Aspect ratio 8.97. Dihedral 2°. All-metal structure. Single bracing strut on each side. Slotted inset ailerons. Double slotted flaps. Ailerons and flaps all-metal. Total aileron area 26.3 sq. ft. (2.44 m.²). Total area of flaps 98 sq. ft. (9.10 m.²). Gross wing area 375 sq. ft. (34.83 m.²).

FUSELAGE.—Of conventional all-metal structure.

TAIL UNIT.—Cantilever monoplane type with tailplane halfway up fin which is integral with fuselage. All-metal structure. Total vertical area 60.2 sq. ft. (5.6 m.²). Total horizontal area 84.0 sq. ft. (7.8 m.²). Span of tail 21 ft. 2 in. (6.45 m.).

LANDING GEAR.—Interchangeable wheels, floats or skis. Wheel gear has D.H. rubber-in-compression springing. Goodyear wheels and brakes. Track 11 ft. 2 in. (3.40 m.). Wheelbase 27 ft. 10 in. (9.08 m.). Wheels interchangeable with twin Edo 7170 all-metal single-step floats, D.H. skis or D.H. combination wheel-skis. Float base (C/L. of floats) 10 ft. 6 in. (3.20 m.).

POWER PLANT.—One 600 h.p. Pratt & Whitney R-1340-S3H1-G radial air-cooled engine driving a three-blade Hamilton Standard Hydromatic airscrew 11 ft. (3.35 m.) diameter. Special exhaust system with four augmenter stacks. In these stacks exhaust gases produce suction strong enough to pull cooling air through engine and from behind engine accessories compartment while at same time providing measurable amount of thrust in cruising flight. Engine is effectively cooled during steep climbs when forward air speed is low and engine output near its maximum. Fuel tanks under cabin floor. Capacities: front 51 Imp. gallons (230 litres), middle (two cells) 85 Imp. gallons (386 litres), rear 42 Imp. gallons (190 litres). Total internal fuel capacity: 178 Imp. gallons (830 litres). Oil capacity 9 Imp. gallons (41 litres). Oil dilution system. Remote control fire-extinguisher system in engine compartment.



The DHC-3 Otter.

ACCOMMODATION.—Pilot's compartment seats two side-by-side, pilot (port) and co-pilot or passenger. Dual rudder pedals and W-type control column with throw-over wheel. Door on each side and one in bulkhead to cabin. Cabin is 16 ft. 5 in. (5.0 m.) long, 5 ft. 2 in. (1.58 m.) wide and 4 ft. 11 in. (1.5 m.) high, divided by bulkhead into 12 ft. 8 in. (3.8 m.) long main passenger or freight compartment and stowage compartment. Volume of main compartment 272 cub. ft. (7.6 m.³), of stowage compartment 38 cub. ft. (1.06 m.³). Doors on each side of main compartment 46.5 in. (118 cm.) wide on port, 30 in. (76.2 cm.) wide on starboard. Reinforced cargo floor. Cargo drop hatch, camera hole or para-troop exit in floor of stowage compartment. standard seating accommodation—9 passengers in cabin, plus one in cockpit.



The first DHC-3 Otter to be delivered to the Royal Canadian Air Force.

Optional seating—up to 13 passengers on folding bench seats on sides of cabin, plus one in cockpit. Alternatively, 6 stretchers and 4 passenger seats or 3 stretchers and 7 passenger seats. All seats quickly removable.

DIMENSIONS. -
Span 58 ft. (17.69 m.).
Length (landplane and seaplane) 41 ft. 10 in. (12.80 m.).
Height (landplane) 12 ft. 7 in. (3.83 m.).
Height (seaplane) 15 ft. 0 in. (4.57 m.).

WEIGHTS (Provisional).—
Weight empty (landplane) 4,143 lb. (1,880 kg.).
Weight empty (seaplane) 4,744 lb. (2,150 kg.).
Weight loaded 7,600 lb. (3,450 kg.).

PERFORMANCE (Landplane/Skiplane).
Max. speed 160 m.p.h. (257 km.h.).
Cruising speed (66% power) 139 m.p.h. (224 km.h.) at 5,000 ft. (1,525 m.).
Initial rate of climb 1,000 ft./min. (305 m./min.).
Service ceiling 20,000 ft. (6,070 m.).
Max. range (full tanks) 1,050 miles (1,690 km.).
Max. endurance 10.5 hours.
Take-off distance to 50 ft. (15.25 m.) (no wind) 1,050 ft. (320 m.).
Landing distance from 50 ft. (15.25 m.) 1,080 ft. (330 m.).

PERFORMANCE (Seaplane).
Max. speed 153 m.p.h. (246 km.h.).
Cruising speed (66% power) 128 m.p.h. (206 km.h.).
Max. range (full tanks) 1,000 miles (1,600 km.).
Max. endurance 10 hours.
Take-off distance to 50 ft. (15.25 m.) 1,200 ft. (366 m.).
Landing distance from 50 ft. (15.25 m.) 1,290 ft. (393 m.).

NOTE.—Range and endurance include allowances for 10 min. warm-up, take-off, climb to 5,000 ft. (1,525 m.) and fuel for 45 minutes at cruise power in reserve.



The DHC-2 Beaver Light Transport as a skiplane.



The DHC-2 Beaver Twin-float Seaplane.

THE DHC-2 BEAVER.

U.S.A.F. designation : L-20.

TYPE.—Single-engined Seven-seat Charter and Freight landplane, seaplane or skiplane.

WINGS. — High-wing braced monoplane. D.H. high-lift wing section. All-metal two-spar structure. Single bracing struts on each side. Entire trailing-edge hinged. Slotted ailerons and flaps interconnected so that when flaps are lowered to maximum angle of 58° the ailerons droop progressively to about 15° while retaining full lateral control. Hydraulic flap operation. Gross wing area 250 sq. ft. (23.2 m.²).

FUSELAGE.—Rectangular all-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering.

LANDING GEAR. — Interchangeable floats, wheels and skis. Rubber-in-compression cantilever single-leg wheel gear with steerable tail-wheel. Goodyear wheels and brakes. Twin Edo Model 58-4580 all-metal floats. Float base (C/L of floats) 9 ft. 6¾ in. (2.92 m.).

POWER PLANT.—One 450 h.p. Pratt & Whitney R-985 Wasp Junior nine-cylinder radial air-cooled engine driving a two-blade Hamilton Standard controllable-pitch airscrew 8 ft. 6 in. (2.59 m.) diameter. Fuel tanks (3) are under the cabin floor and easily removable for servicing. Tank fillers in fuselage sides to permit refuelling from ground or floats. Maximum internal fuel capacity 79 Imp. gallons (359 litres). Provision for wing-tip tanks of 34 Imp. gallons (155 litres) capacity. Oil tank and cooler in engine compartment aft of firewall. Oil-dilution system. Hand and electric starters. Remote-control fire-extinguishing system in engine compartment in civil version only.

ACCOMMODATION.—Pilot's compartment with pilot on port side and removable seat on starboard. Dual rudder pedals and Y-type control column with throw-over wheel. Entrance door with automobile-type sliding windows on each side. Cabin may seat seven passengers. Cabin heating. Floor stressed for freight-carrying. Lightweight collapsible bush-seats are interchangeable with cargo attachments. Two side doors, one on each side, wide enough to roll a 45-gallon petrol drum into cabin on its side. Hatches in rear wall of cabin to enable long pieces of freight, such as 10 ft. drilling-rods, to be loaded and stowed. Adequate baggage space at back of cabin, with separate locker aft for emergency rations, etc. Total cabin capacity 144 cub. ft. (4.03 m.³). Capacity available for freight payload 120 cub. ft. (3.35 m.³).

EQUIPMENT.—24-volt electrical system charged by engine-driven 1,500-watt generator. Batteries in rear fuselage on removable tray accessible through fuselage side. Provision for navigation lights, instrument lighting, anchor riding light and cabin lights. Fittings on floats chassis for 16 ft. canoe. Extra equipment to operators' specifications include radio, agricultural spraying or dusting equipment, etc.

DIMENSIONS.—
Span 48 ft. (14.64 m.).
Length (landplane) 30 ft. 3 in. (9.22 m.).
Length (seaplane) 32 ft. 9 in. (9.98 m.).
Height (landplane) 9 ft. 0 in. (2.75 m.).
Height (seaplane) 10 ft. 5 in. (3.18 m.).

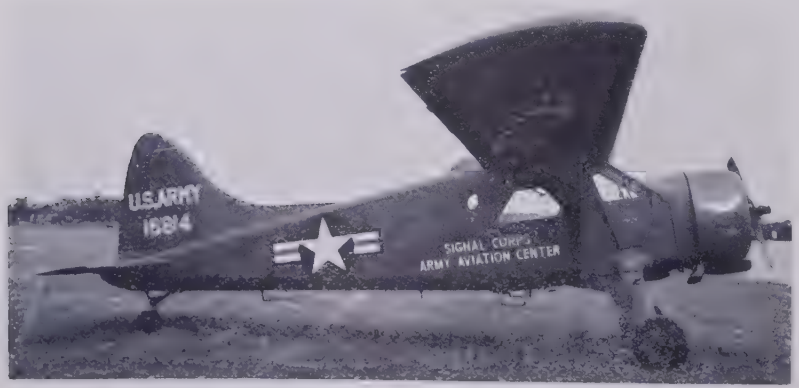
WEIGHTS (Landplane).—
Weight empty 2,960 lb. (1,343 kg.).
Weight loaded 5,100 lb. (2,300 kg.).

WEIGHTS (Seaplane).—
Weight empty 3,248 lb. (1,473 kg.).
Weight loaded 5,100 lb. (2,300 kg.).

PERFORMANCE (Landplane/Skiplane).—
Max. speed at sea level 163 m.p.h. (262 km.h.).
Cruising speed at 5,000 ft. (1,525 m.) 140 m.p.h. (225 km.h.).
Initial rate of climb 1,020 ft./min. (311 m./min.).
Service ceiling 19,000 ft. (5,795 m.).
Max. range (internal fuel only) 445 miles (730 km.).
Max. range (with wing-tip tanks) 740 miles (1,190 km.).
Take-off distance to 50 ft. (15.25 m.) 1,250 ft. (380 m.).
Landing distance from 50 ft. (15.25 m.) 1,250 ft. (380 m.).

PERFORMANCE (Seaplane).
Max. speed 148 m.p.h. (237 km.h.) at sea level.
Cruising speed at 5,000 ft. (1,525 m.) 129 m.p.h. (207 km.h.).
Initial rate of climb 920 ft./min. (281 m./min.).
Service ceiling 16,500 ft. (5,790 m.).
Max. range (internal fuel only) 410 miles (656 km.).
Max. range (with wing-tip tanks) 665 miles (1,065 km.).
Take-off distance to 50 ft. (15.25 m.) 1,610 ft. (490 m.).
Landing distance from 50 ft. (15.25 m.) 1,500 ft. (457 m.).

NOTE.—Ranges include allowance for 10 minute warm-up, take-off, climb to 5,000 ft. and reserve fuel for 45 minutes flight at cruise power.



The L-20, the U.S. Army liaison version of the DHC-2 Beaver.

FAIREY

FAIREY AVIATION CO. OF CANADA LTD.

HEAD OFFICE AND WORKS: EASTERN PASSAGE, HALIFAX, N.S.

President: Sir Richard Fairey, M.B.E., F.R.Ae.S.

Vice-President: Shirley G. Dixon.

Director and General Manager: Charles Hibbert, M.B.E.

Chief Designer: E. C. Garrard, A.M.I. Mech.E., A.F.R.Ae.S.

Secretary and Treasurer: A. M. Cameron.

The Fairey Aviation Co. of Canada, Ltd. was formed in November, 1948, primarily to undertake the maintenance, overhaul and repair of aircraft for the Royal Canadian Navy.

In the Summer of 1950 the company began design work on the conversion of the Grumman TBM-3E Avenger into an anti-submarine aircraft for the Royal Canadian Navy. The prototype first flew in November, 1950, and an appreciable number of these aircraft have now been converted.

In the Summer of 1951 the company undertook the conversion of a number of Lancaster Mk. 10 aircraft into long-range navigational trainers for the R.C.A.F.

Similar Lancaster conversions, together with the Avenger programme, necessitated the original factory space being nearly doubled in 1952, giving a total floor space of 210,000 sq. ft. The labour force, which stood at 550 at the end of 1951, now approaches 1,000.

Repair and maintenance work is now primarily concentrated on Hawker Sea Fury aircraft for the Royal Canadian Navy.

The company is now setting up facilities for the manufacture, under sub-contract to A. V. Roe, Canada, of hydro-booster units for all three control surfaces of the C.F.100 all-weather fighter, which is in production for the R.C.A.F.

INDIA

HINDUSTAN

HINDUSTAN AIRCRAFT LTD.

HEAD OFFICE AND WORKS: BANGALORE (MYSORE STATE).

Chairman of the Board of Directors: H. M. Patel, Secretary, Ministry of Defence, Government of India.

Directors: E. V. Ganapathy Iyer, Director of Industries and Commerce, Mysore, and J. R. D. Tata.

Chairman of the Board of Management and General Manager: J. M. Shrinagesh, C.I.E.

Members of the Board of Management: J. R. Standring, M.I.Mech.E., F.R.Ae.S. (Chief Production Engineer), Dr. V. M. Gahtage, M.Sc., D.Phil., A.F.R.Ae.S. (Chief Designer) and V. G. Kamath (Finance Manager).

Hindustan Aircraft Ltd., was formed in 1940 to undertake the manufacture of aeroplanes for the Indian market. The capital of the Company was originally held jointly by the Government of India, the Mysore Government and Mr. Walchand Hirachand. The present shareholders are the two Governments mentioned above.

The Aircraft Design and Development Department is under the direction of Dr. V. M. Ghatage, M.Sc., D.Phil., A.F.R.Ae.S., as Chief Designer. A basic trainer called the Hindustan Trainer 2 (HT-2) has been designed and developed for the use of the Indian Air Force and for civilian basic training, and is being put into production. The design of an advanced trainer known as the HT-10 has reached its final stages and work on the first prototype is progressing.

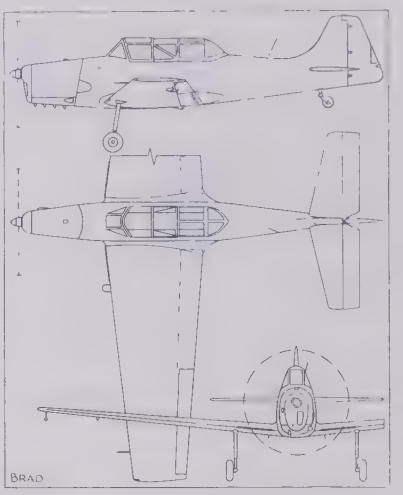
The Company has also undertaken the assembly and manufacture of Percival Prentice trainers on a contract basis with Percival Aircraft Ltd., Luton, England. The delivery of 62 of these aircraft had been completed by the beginning of 1953.

A number of D.H. Vampire fighter aircraft have been assembled for the Indian Air Force and complete manufacture of the Vampire has also begun.

Among other activities of Hindustan Aircraft, Ltd. is the manufacture of steel railway coach bodies and light alloy omnibus bodies.



The Hindustan HT-2 Two-seat Primary Trainer.



The Hindustan HT-2.

THE HINDUSTAN HT-2.

TYPE.—Two-seat Primary Trainer.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23012. Aspect ratio 7.13. Dihedral 5.15 degrees. All-metal two-spar structure. All-metal split flaps. Area of ailerons (2) 14.35 sq. ft. (1.33 m.²). Total flap area 14.18 sq. ft. (1.31 m.²). Gross wing area 173.4 sq. ft. (16.0 m.²).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Areas: fin 9.34 sq. ft. (0.86 m.²), rudder 8.17 sq. ft. (0.75 m.²), tailplane 16.8 sq. ft. (1.58 m.²), elevators (2) 11.2 sq. ft. (1.05 m.²).

LANDING GEAR.—Fixed tail-wheel type. Hindustan oleo-pneumatic shock-absorber struts. Dunlop wheels and hydraulic single-disc type brakes. Track: 9 ft. (2.74 m.).

POWER PLANT.—One 155 h.p. Cirrus Major III four-cylinder in-line inverted air-cooled engine driving a two-blade fixed-pitch wood airscrew. Two fuel tanks in wings. Total fuel capacity 26 Imp. gallons (117 litres).

ACCOMMODATION.—Enclosed tandem cockpits with dual controls.

DIMENSIONS.
Span 35 ft. 2 in. (10.72 m.).
Length 24 ft. 8.6 in. (7.53 m.).
Height 8 ft. 11 in. (2.74 m.).

WEIGHTS.
Weight empty 1,540 lb. (702 kg.).
Weight loaded 2,240 lb. (1,018 kg.).

PERFORMANCE.
Max. speed 130 m.p.h. (209 km.h.).
Cruising speed 115 m.p.h. (185 km.h.).
Stalling speed without flaps 52 m.p.h. (84 km.h.).
Initial rate of climb 800 ft./min. (244 m./min.).
Service ceiling 14,500 ft. (4,420 m.).
Absolute ceiling 16,500 ft. (5,060 m.).
Still air range 350 miles (560 km.).
Endurance at cruising speed 3.5 hours.

THE HINDUSTAN HT-10.

TYPE.—Two-seat Advanced Trainer.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 6.0. Dihedral 5 degrees. Leading-edge sweepback 3° 45′. All-metal stressed skin construction. All-metal split flaps. Aileron area 29 sq. ft. (2.69 m.²). Total flap area 30.6 sq. ft. (2.84 m.²). Gross wing area 318.46 sq. ft. (29.58 m.²).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal stressed-skin structure. Areas: fin 12.27 sq. ft. (1.14 m.²), rudder 13.10 sq. ft. (12.16 m.²), tailplane 36.23 sq. ft. (3.4 m.²), elevators (2) 20.47 sq. ft. (1.90 m.²).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic actuation. Hindustan oleo-pneumatic shock-absorber struts. Track: 12 ft. (3.66 m.). Wheelbase: 10 ft. 6 in. (3.20 m.).

POWER PLANT.—One 1,050 h.p. Pratt & Whitney R-1820-92 fourteen-cylinder radial air-cooled engine driving a Hamilton Standard Hydromatic constant-speed quick-feathering airscrew. Three fuel tanks, two in wings and one in fuselage. Total fuel capacity 180 Imp. gallons (817 litres)

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls.

DIMENSIONS.—
Span 43 ft. 9 in. (13.34 m.).
Length 32 ft. 10 in. (10.00 m.).
Height 15 ft. 1½ in. (4.60 m.).

WEIGHTS (Designed).
Weight empty 6,280 lb. (2,850 kg.).
Weight loaded 8,500 lb. (3,860 kg.).

PERFORMANCE (Estimated).—
Max. speed 230 m.p.h. (368 km.h.) at 7,500 ft. (2,290 m.).
Stalling speed without flaps 83 m.p.h. (51.4 km.h.).
Initial rate of climb 2,000 ft./min. (610 m./min.).
Service ceiling 27,000 ft. (8,235 m.).
Absolute ceiling 28,000 ft. (8,540 m.).



The first six production Hindustan HT-2 Trainers ready for delivery to the Indian Air Force

NEW ZEALAND

DE HAVILLAND

THE DE HAVILLAND AIRCRAFT CO. OF NEW ZEALAND, LTD.

HEAD OFFICE AND WORKS: RONGOTAI, WELLINGTON.

Directors: Sir Geoffrey de Havilland, F. E. N. St. Barbe, W. E. Nixon, A Murray Jones and J. A. Kerr.

Secretary: D. W. Gendall.

The New Zealand branch of the de Havilland Aircraft Co., Ltd., was formed early in 1939. An initial order for 100 Tiger Moths was placed with the Company by the New Zealand Government and delivery began in May, 1940.

By the end of the war the New Zealand factory had built 345 Tiger Moths for the Royal New Zealand Air Force. The company also overhauled and rebuilt D.H. aircraft and Gipsy engines, as well as Airspeed Oxford trainers, for which the manufacture of major components was also undertaken. Other types of British and American engines were also overhauled in the Rongotai factory.

Since the war the company has been engaged in the servicing, maintenance and overhaul of aircraft and engines for the Royal New Zealand Air Force, the N.Z. National Airways Corpn., Aero Clubs and private owners. The company has also assembled some D.H. Devons for the R.N.Z.A.F. and a number of D.H. Fox Moths and Chipmunks for the Aero Clubs.

CHILE

GOVERNMENT WORKSHOPS

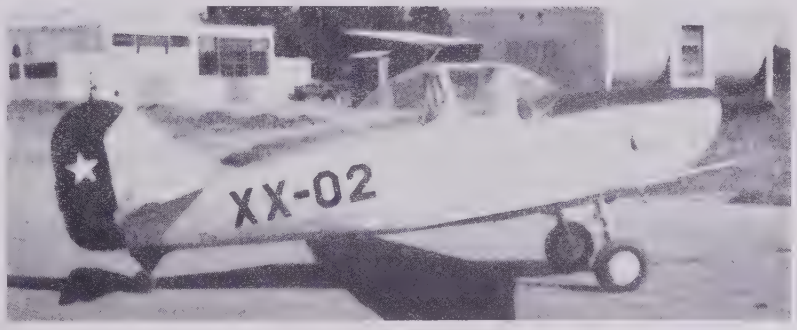
MAESTRANZA CENTRAL DE AVIACION.

"EL BOSQUE" AIR BASE, SANTIAGO.

Director; Cmdte. Escdlla (R.I.) Fernando Fagalde Murua.

The first aeroplane of Chilean conception, the Triciclo-Experimental was built by the Maestranza Central de Aviacion, the Central Workshops of the Chilean Air Force. Designed by Senõr Alfredo Davins Ferrer, it was built by Chileans of Chilean materials, the only imported component being the 100 h.p. Franklin engine with which it is powered. This aeroplane was first demonstrated in public at a national ceremony, at which the President of the Republic, members of the Government and Air Force Chiefs were present, at the "El Bosque" Airport, Santiago, in May, 1947. The Triciclo-Experimental has been described and illustrated in previous editions of this Annual.

The establishment has now built the XX-02, a two-seat side-by-side training monoplane which has been designed by Capt. de Bandada Hugo Fuentes, an aeronautical engineer who received his training in Europe.



The H.F. XX-02 Two-seat Trainer (175 h.p. Ranger L-440 engine).

THE H.F. XX-02.

TYPE.—Two-seat Trainer.

WINGS.—Low-wing cantilever monoplane. NACA 23012 wing section. Aspect ratio 7.13. Mean chord 1.62 m. (5 ft. 4 in.). Dihedral 5°. Incidence 3°. Plywood-covered wood structure using national timbers. Both flaps and ailerons have wood frames and fabric covering. Total flap area 1.0 m.² (10.76 sq. ft.), total aileron area 1.2 m.² (12.91 sq. ft.). Gross wing area 16.96 m.² (182.5 sq. ft.).

FUSELAGE.—Welded steel-tube structure covered with fabric.

TAIL UNIT.—Cantilever monoplane type. All-wood structure. Tailplane span 3.24 m. (10 ft. 7 in.). Areas: fin 0.62 m.² (6.67 sq. ft.), rudder 0.90 m.² (9.68 sq. ft.), tailplane 1.19 m.² (12.80 sq. ft.), elevators (total) 0.98 m.² (10.54 sq. ft.).

LANDING GEAR.—Fixed tail-wheel type. Bendix hydraulic shock-absorber struts. Hayes 752-M wheels with 650 × 10 tyres. Goodyear expander tube type brakes. Wheel track 2.20 m. (7 ft. 2½ in.).

POWER PLANT.—One 175 h.p. Ranger L-440-1 four-cylinder in-line inverted air-cooled engine. Two-blade National wood airscrew. Two fuel tanks, one in each wing root, with total capacity of 140 litres (31 Imp. gallons).

ACCOMMODATION.—Crew of two side-by-side with dual controls.

DIMENSIONS.—
Span 11.0 m. (36 ft. 1 in.).
Length 6.42 m. (21 ft. 0 in.).
Height 2.14 m. (7 ft.).
Wing area 16.96 m.² (182.4 sq. ft.).

WEIGHT AND LOADING (Designed).
Weight loaded 900 kg. (1,980 lb.).
Wing loading 59 kg./m.² (22.33 lb./sq. ft.).

PERFORMANCE (Estimated). –
Max. speed 230 km.h. (143 m.p.h.).
Landing speed 70 km.h. (43.5 m.p.h.).
Max. diving speed 353 km.h. (219 m.p.h.).

CZECHOSLOVAKIA

ČESKOSLOVENSKÉ ZÁVODY AUTOMOBILOVÉ A LETECKÉ (Czechoslovak Automobile and Aircraft Works).

HEAD OFFICE: KRIZÍKOVA 38, PRAGUE X.

General Manager: F. Horák.

In this concern are grouped all the factories engaged in the production of aircraft, aero-engines, airscrews, aviation instruments and equipment, etc.

The sale of all the aviation products as well as the information service are handled exclusively by:

MOTOKOV LIMITED (Vehicle and Light Engineering Import and Export Company).

AVIATION SALES DEPARTMENT, TŘ. DUKEL HRDINŮ 27, PRAGUE VII.



The LG125 Sohaj Single-seat High-performance Sailplane.

THE LG125 SOHAJ 2.

TYPE.—Single-seat High Performance Sailplane.

WINGS.—High-wing single-spar cantilever monoplane. Leading-edge forms with the main spar a torsional box and is covered with diagonally-laid plywood strips. The remainder is covered with fabric. High aspect-ratio ailerons with differential control hinged to fittings on reinforced ribs. Dive brakes. Wing area 14 m.² (150.7 sq. ft.).

FUSELAGE.—Oval-section three-longeron structure covered with plywood. Nose is in form of a removable elektron fairing.

TAIL UNIT.—Cantilever monoplane. Tailplane and fin are single-spar structures covered with diagonal plywood. Elevators and rudder also single-spar structures with plywood leading-edges and fabric over remainder.

LANDING GEAR.—Single low-pressure wheel with brake, forward landing skid, tail skid with rubber shock-absorber.

ACCOMMODATION.—Enclosed pilot's cockpit with moulded single-piece transparent upward hingeing hood. Cabin ventilation. All flight and blind flying instruments. Provision for back-type parachute.

DIMENSIONS.—
- Span 15 m. (49 ft. 2½ in.).
- Length 7.13 m. (23 ft. 4¾ in.).
- Height 1.2 m. (3 ft. 11 in.).

WEIGHTS AND LOADINGS.—
- Weight empty 180 kg. (397 lb.).
- Disposable load 115 kg. (253 lb.).
- Weight loaded 295 kg. (650 lb.).
- Wing loading 21 kg./m.² (4.3 lb./sq. ft.).

PERFORMANCE.—
- Gliding ratio 1 : 27 at 75 km.h. (46.6 m.p.h.).
- Min. sinking speed 0.7 m./sec. (2.3 ft./sec.). at 65 km.h. (40.4 m.p.h.).
- Sinking speed at 100 km.h. (62 m.p.h.) 1.5 m./sec. (4.9 ft./sec.).
- Stalling speed 54 km.h. (33.5 m.p.h.).
- Max. permissible winch towing speed 100 km.h. (62 m.p.h.).
- Max. permissible aero towing speed 150 km.h. (93 m.p.h.).
- Max. permissible diving speed with dive-brakes extended 215 km.h. (134 m.p.h.).

THE ZLIN 22.

TYPE.—Two-seat or three-seat Training and Touring monoplane.

WINGS.—Cantilever low-wing monoplane. Wooden two-spar structure. Centre-section entirely plywood-covered. Outer wings have forward portions covered with plywood and the remainder with fabric. Split flaps extend from aileron to aileron beneath fuselage and all sections interconnected. Mechanical operation. Max. flap depression 60°. Wing area 14.65 m.² (157.7 sq. ft.).

FUSELAGE.—Wooden monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Wooden structure with ply-covered fin and tailplane and fabric covering to rudder and one-piece elevator. Controllable trim-tab in elevator.

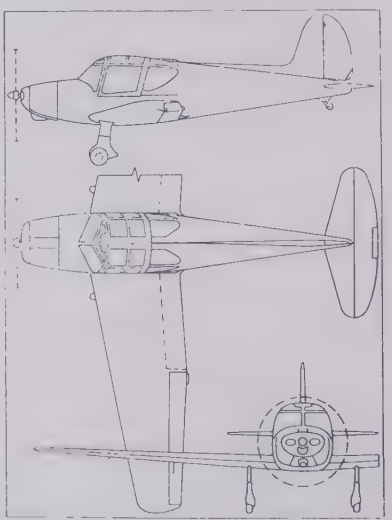
LANDING GEAR.—Fixed tail-wheel type. Oleo-pneumatic cantilever shock-absorber struts. Differential mechanically-operated wheel-brakes. Fully-castoring and steerable oleo-sprung tail-wheel. Wheel track 2.08 m. (6 ft. 9½ in.). Wheels can be replaced by skis.

POWER PLANT.—One 75 h.p. Praga D four-cylinder horizontally-opposed, air-cooled engine driving two-blade fixed-pitch wooden airscrew. Normal fuel capacity is 72 litres (15.8 Imp. gallons) in main tank in port centre-section and gravity tank in fuselage. For long-range a second main tank, capacity 65 litres (14.3 Imp. galls.), may be installed in star-board centre-section. This second main tank is fitted for two-seater version only.

ACCOMMODATION. — Enclosed cabin with accommodation for pilot and passenger side-by-side. Optional, a third seat can be fitted behind the front seats (for version with 650 km. (400 mile) range only). Dual controls with starboard column removable. Sliding canopy. Luggage compartment aft of seats. Optional equipment: cabin heating, electric equipment, radio, blind flying instruments.

DIMENSIONS.—
- Span 10.60 m. (34 ft. 9 in.).
- Length 7.25 m. (23 ft. 9½ in.).
- Height 1.96 m. (6 ft. 5 in.).

WEIGHTS AND LOADINGS (two-seat trainer).—
- Weight empty 365 kg. (804 lb.).
- Crew (2) 155 kg. (342 lb.).
- Fuel and oil 60 kg. (132 lb.).
- Weight loaded 580 kg. (1,278 lb.).



The Zlin 22 Light Monoplane.



The Zlin 22 Cabin Monoplane (75 h.p. Praga D engine).

- Wing loading 39.5 kg./m.² (8.1 lb./sq. ft.).
- Power loading 7.7 kg./h.p. (170 lb./h.p.).

WEIGHTS AND LOADINGS (two-seat tourer).—
- Weight empty 370 kg. (816 lb.).
- Crew (2) 155 kg. (342 lb.).
- Fuel and oil 105 kg. (231 lb.).
- Luggage 20 kg. (44 lb.).
- Weight loaded 650 kg. (1,433 lb.).
- Wing loading 44.3 kg./m.² (9.0 lb./sq. ft.).
- Power loading 8.6 kg./h.p. (19.1 lb./h.p).

WEIGHTS AND LOADINGS (three-seat tourer).—
- Weight empty 365 kg. (804 lb.).
- Crew (3) 232 kg. (510 lb.).
- Fuel and oil 60 kg. (132 lb.).
- Weight loaded 660 kg. (1,456 lb.).
- Wing loading 45.3 kg./m.² (9.2 lb./sq. ft).
- Power loading 8.8 kg./h.p. (19.4 lb./h.p.).

PERFORMANCE (two-seat trainer).—
- Max. speed 180 km.h. (112 m.p.h.).
- Cruising speed 160 km.h. (100 m.p.h.).
- Landing speed with flaps 55 km.h. (34 m.p.h.).
- Initial rate of climb 180 m./min. (590 ft./min.).
- Service ceiling 4,500 m. (14,700 ft.).
- Cruising range 650 km. (400 miles).
- Take-off run with flaps 120 m. (130 yds.).
- Landing run with flaps and brakes 100 m. (110 yds.).

PERFORMANCE (two-seat tourer).—
- Max. speed 180 km.h. (112 m.p.h.).
- Cruising speed 160 km.h. (100 m.p.h.).
- Landing speed 65 km.h. (40 m.p.h.).
- Initial rate of climb 140 m./min. (460 ft./min.).
- Service ceiling 3,800 m. (12,400 ft.).
- Cruising range 1,200 km. (740 miles).
- Take-off run with flaps 150 m. (165 yds.).
- Landing run with flaps and brakes 130 m. (140 yds.).

PERFORMANCE (three-seat tourer).—
- The same as for the two-seat plane, except the cruising range 650 km. (400 miles).
- Fuel consumption at cruising speed 17.3 litres/hour (3.8 Imp. galls./hour).

THE SOKOL (FALCON) M-1-D.

TYPE.—Three-seat Sports aircraft. Trainer, Tourer or Air-taxi.

WINGS.—Cantilever low-wing monoplane. Wooden structure. Two box spars, ribs and plywood covering, over which is a covering of fabric. Wooden ailerons with fabric covering. Split trailing-edge flaps between ailerons and fuselage hinged on rear auxiliary spar. Wing area 13.8 m.² (148.5 sq. ft.).

FUSELAGE.—Wooden box-type structure with plywood covering.

TAIL UNIT.—Cantilever monoplane type. Wooden fin and tailplane built integral with fuselage and covered with plywood over which is a covering of fabric. One-piece elevator and rudder of wooden constructon with fabric covering. Trim-tabs in elevator and rudder, former adjustable in flight.

LANDING GEAR. — Retractable tail-wheel type. Mechanical operation by hand-crank. Coil spring shock-absorbers and friction dampers. Mechanically-operated wheel brakes. Non-retractable self-centering tail-wheel on coil spring shock-absorber. Wheels can be replaced by skis.

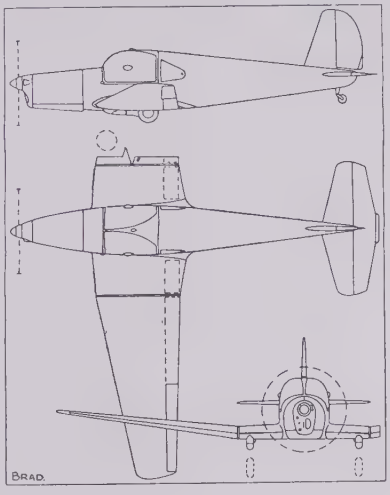
POWER PLANT.—One 105 h.p. Walter Minor 4-III four-cylinder in-line inverted air-cooled engine on welded steel mounting, and driving two-blade fixed-pitch wooden airscrew or controllable-pitch metal airscrew or variable-pitch airscrew. Hand or electric starter. Two fuel tanks of 110 litres (24.2 Imp. galls.) capacity in centre-section and gravity tank of 15 litres (3.3 Imp. gallons) capacity in fuselage behind engine bulkhead.

ACCOMMODATION. Enclosed cabin with two seats side-by-side and third central seat behind. Dual controls. Seats designed for back-type parachutes. For access, the transparent cabin hood hinges upwards. Luggage rack aft of seats. Optional equipment; cabin heating, electric equipment, blind flying equipment, radio.

DIMENSIONS.—
Span 10 m. (32 ft. 9¾ in.).
Length 7.35 m. (24 ft. 1 in.).
Height (tail up, over cabin) 2.2 m. (7 ft. 2⅜ in.).
WEIGHTS AND LOADINGS (with normal equipment).—
Weight empty 425 kg. (938 lb.).
Pilot and two passengers 232 kg. (510 lb.).
Baggage 30 kg. (66 lb.).
Fuel and oil 93 kg. (206 lb.).
Max. weight loaded 780 kg. (1,720 lb.).
Wing loading 56.5 kg./m.² (11.58 lb./sq. ft.).
Power loading 7.4 kg./h.p. (16.4 lb./h.p.).
WEIGHTS AND LOADINGS (with electric equipment, radio and V.P. airscrew).—
Weight empty 475 kg. (1,047 lb.).
Pilot and two passengers 232 kg. (510 lb.).
Baggage 15 kg. (33 lb.).
Fuel and oil 93 kg. (206 lb.).
Max. weight loaded 815 kg. (1,796 lb.).
Wing loading 59 kg./m.² (12.09 lb./sq. ft.).
Power loading 7.76 kg./h.p. (17.1 lb./h.p.).
PERFORMANCE.—
Max. speed 240 km.h. (150 m.p.h.).
Cruising speed (65% power) 212 km.h. (132 m.p.h.).
Landing speed with flaps 75 km.h. (46.6 m.p.h.).
Initial rate of climb 180 m./min. (590 ft./min.).
Service ceiling 4,800 m. (15,700 ft.).
Cruising range 1,000 km. (620 miles).
Take-off run, with flaps 190 m. (208 yds.).
Landing run with brakes and flaps 170 m. (185 yds.).
Fuel consumption at cruising speed 24.4 litres/hour (5.37 Imp. gallons/hour).



The Sokol MID Cabin Monoplane (105 h.p. Walter Minor 4-III engine).



The Sokol MID Light Monoplane.

THE AERO 45.

TYPE.—Twin-engined Sports aircraft, Trainer, Tourer, Business Transport plane, Air-taxi or small Feeder-liner.
WINGS.—Cantilever low-wing monoplane. All-metal two-spar structure. I-section spars, duralumin ribs and sheet duralumin covering. Statically and dynamically-balanced ailerons have metal frames and fabric covering. Leading-edge slots between fuselage and engine nacelles. Electrically-operated two-position split trailing-edge flaps, in two sections each side. Wing area 17.1 m.² (184 sq. ft.).
FUSELAGE.—Metal monocoque structure. Nose section hinged for access to controls and battery.
TAIL UNIT.—All-metal cantilever monoplane type. Fin integral with fuselage. Fixed surfaces metal-covered. Statically and dynamically-balanced rudder and elevators have metal frames and fabric covering. Controllable trim-tabs in rudder and elevators.
LANDING GEAR.—Retractable two-wheel type. Oleo-pneumatic shock-absorber legs. Electrical operation, with emergency mechanical gear. Low-pressure tyres, and mechanically-operated brakes. Track 2.93 m. (9 ft. 7 in.). Castoring oleo-sprung tail-wheel, with centre-lock and with earth cable. Wheels can be replaced by skis or floats.
POWER PLANT.—Two 105 h.p. Walter Minor 4-III four-cylinder in-line air-cooled engines flexibly mounted on light metal bearers. Two-blade metal airscrews; VP propellers, optional. Fuel capacity 174 litres (38.3 Imp. gallons) in inter-spar light alloy tanks; two additional fuel tanks of 140 litres (30.8 Imp. gallons) capacity optional. Aluminium oil-tank behind each engine. Electric starters.
ACCOMMODATION.—Enclosed cabin seating pilot (on port) and one passenger side-by-side with single or dual controls, and two or three passengers behind on full-width seat. Access door on port side hinges upwards. Front seats adjustable. Cabin heat and sound proofed and ventilated; if desired, also heated. Large luggage compartment behind rear seats. Flight and blind flying instruments. Complete electric equipment. Radio, if desired.
DIMENSIONS.—
Span 12.3 m. (40 ft. 4 in.).
Length 7.54 m. (24 ft. 9 in.).
Height 2.30 m. (7 ft. 6 in.).
WEIGHTS AND LOADINGS for range 850 km. (530 miles).—
Weight empty 845 kg. (1,862 lb.).
Crew 308 kg. (680 lb.).
Fuel 127 kg. (279 lb.).
Oil 15 kg. (33 lb.).
Luggage 105 kg. (231 lb.).
Weight loaded 1,400 kg. (3,085 lb.).
Wing loading 81.9 kg./m.² (16.7 lb./sq. ft.).
Power loading 6.7 kg./h.p. (14.8 lb./h.p.).
WEIGHTS AND LOADINGS for range 1,500 km. (930 miles).—
Weight empty 860 kg. (1,896 lb.).
Crew 308 kg. (680 lb.).
Fuel 227 kg. (500 lb.).
Oil 15 kg. (33 lb.).
Luggage 90 kg. (197 lb.).
Weight loaded 1,500 kg (3,306 lb.).
Wing loading 87.8 kg./m². (18.0 lb./sq. ft.).
Power loading 7.1 kg./h.p. (15.7 lb./h.p.).
PERFORMANCE.—
Max. speed 285 km.h. (177 m.p.h.).
Cruising speed (75% power) 245 km.h. (152 m.p.h.).
Landing speed 80 km.h. (50 m.p.h.).
Initial rate of climb 300 m./min. (980 ft./min.).
Service ceiling 5,700 m. (18,700 ft.).
Service ceiling on one engine 1,500 m. (4,900 ft.).
Absolute ceiling 6,400 m. (21,000 ft.).
Take-off run (with flaps) to clear 50 ft. (15.25 m.) 350 m. (383 yds.).
Landing run, with flaps and brakes 190 m. (208 yds.).
Range 850 km. (530 miles) or 1,500 km. (930 miles).
Fuel consumption at cruising speed 50 litres/hour (11 Imp. gallons/hour).



The Aero 45 (two 105 h.p. Walter Minor 4-III engines).

DENMARK

KZ

SKANDINAVISK AERO INDUSTRI A/S.

HEAD OFFICE AND WORKS: AIRPORT OF COPENHAGEN, KASTRUP

Directors: Morgens Harttung, V. Kramme and K. G. Zeuthen

Skandinavisk Aero Industri A/S was founded in 1937 to manufacture light aircraft. The company was financed by a large Danish industrial concern and took over the aircraft manufacturing business formerly conducted by Messrs. Kramme & Zeuthen, who had previously built the KZ I light single-seat monoplane.

Since its formation the company has built the KZ II two-seat primary trainer, a small series of which was supplied to the Danish Air Force; the KZ III two-seat and the KZ VII Lark four-seat cabin monoplanes, both of which have been built for domestic, European and overseas markets, and the KZ VIII single-seat aerobatic monoplane.

Due to increasing difficulties in marketing civil types abroad under the currency restrictions which exist in most countries at the present time, the company has recently slowed down civil production and is concentrating on military training aircraft and repair and maintenance work.

The company's latest product is the KZ A.O.P. monoplane, which is a modification of the KZ VII to meet the requirements for an artillery observation aircraft. Twelve have been ordered by the Danish Army.

THE KZ X.

TYPE.—Two-seat Light Observation monoplane.

WINGS.—High-wing strut-braced monoplane. Structure consists of spruce box spars, wooden ribs and plywood covering. Full span leading-edge slots. Slotted flaps and ailerons.

FUSELAGE.—Welded steel-tube structure faired with wooden stringers, the whole being fabric-covered.

TAIL UNIT.—Cantilever monoplane type. All-wood adjustable tailplane. Fin integral with fuselage. Rudder and elevator of fabric-covered steel-tube construction.

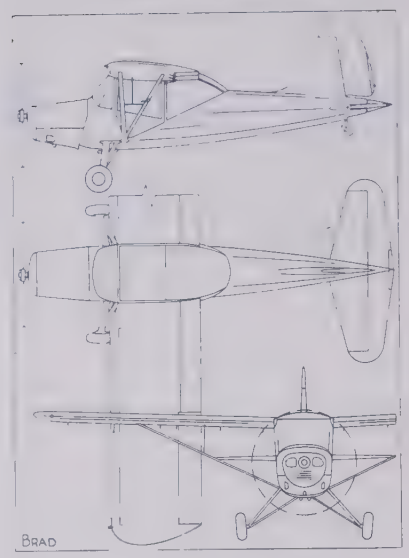
LANDING GEAR.—Fixed split-axle type. Coil springs with friction dampening as the shock absorbing medium. Full castoring and steerable tail-wheel.

POWER PLANT.—One 145 h.p. Continental C145-2 six-cylinder horizontally-opposed air-cooled engine driving an Aeromatic two-blade controllable-pitch airscrew. Starter and generator as standard. Fuel capacity 150 litres (40 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating two in tandem. The rear seat for the observer is on a swivel base. For emergency exit the door (port side) and the rear top Perspex panel are jettisonable.

DIMENSIONS.—
Span 9.4 m. (30 ft. 10 in.).
Length 6.5 m. (21 ft. 4 in.).
Height (tail down) 2.1 m. (6 ft. 11 in.).

WEIGHTS.—
Weight empty 500 kg. (1,100 lb.).
Fuel and oil 115 kg. (255 lb.).



The KZ X A.O.P. monoplane

Pilot and observer 180 kg. (400 lb.).
Equipment (radio, etc.) 65 kg. (144 lb.).
Weight fully loaded 860 kg. (1,900 lb.).

PERFORMANCE.—
Max. speed 215 km.h. (134 m.p.h.).
Cruising (max.) 193 km.h. (120 m.p.h.).
Min. speed 45-50 km.h. (under 30 m.p.h.).
Take-off run 125 m. (410 ft.).
Landing run 50 m. (165 ft.).

THE KZ VII LARK.

TYPE.—Four-seat cabin monoplane.

WINGS.—Braced high-wing monoplane. Aerofoil section NACA 12023. Wooden structure in two main sections attached to top longerons and braced to lower longerons by steel-tube V-struts on each side. Structure consists of two spruce spars and spruce ribs with ply-covered leading-edge and fabric covering aft. Dihedral 2 degrees. Wing area 13 m.² (140 sq. ft.). Slotted ailerons arranged to droop when flaps are lowered. Manually-operated slotted flaps. Built-in fixed slot ahead of front spar running almost complete span.

FUSELAGE.—Welded steel-tube structure with fabric covering.

TAIL UNIT.—Wooden cantilever fin with fabric covering. Horn-balanced and mass-balanced rudder of steel-tube construction with fabric covering. Trim-tab adjustable on ground only. Wooden cantilever tailplane with plywood covering. One-piece elevator has same structure as rudder. Adjustable tailplane with elevator trim-tab automatically connected with tailplane movement.

LANDING GEAR.—Fixed divided type. Consists of two steel-spring shock-absorber legs each braced by V-struts to fuselage centre-line. Low-pressure wheels fitted with 6.00 × 6½ tyres and brakes. Track 2.4 m. (7 ft. 10⅛ in.). Steerable tail-wheel on helical-spring shock-absorber.

POWER PLANT.—One 125 h.p. Continental C125 six-cylinder horizontally-opposed air-cooled engine on welded steel-tube mounting and driving two-blade fixed-pitch wooden airscrew 1.9 m. (6 ft. 4 in.) diameter. Fuel tanks (two) of 110 litres (24 Imp. gallons) total capacity in wings. Oil capacity 8.2 litres (8.2 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating four in two pairs. Interior width 1.22 m. (4 ft. 0 in.). Dual controls with central Y-type control column. Rear seats easily removable to enable the aircraft to be used for various purposes, including training, charter and taxi operations, freight-carrying, etc.

DIMENSIONS.—
Span 9.60 m. (31 ft. 6 in.).
Length 6.56 m. (21 ft. 6 in.).
Height 2.10 m. (6 ft. 11 in.).
Wing area 13 m.² (140 sq. ft.).

WEIGHTS AND LOADINGS.—
Weight empty 464 kg. (1,022 lb.).
Fuel and oil 89 kg. (196 lb.).
Disposable load 314 kg. (693 lb.).
Weight loaded 867 kg. (1,911 lb.).
Wing loading 66.6 kg./m.² (13.5 lb./sq. ft.).
Power loading 6.9 kg./h.p. (15.3 lb./h.p.).

PERFORMANCE.—
Max. speed 200 km. (125 m.p.h.) at sea level.
Cruising speed 185 km.h. (115 m.p.h.).
Landing speed 64 km.h. (40 m.p.h.).
Initial rate of climb 170 m./min. (590 ft./min.).
Service ceiling 4,115 m. (13,500 ft.).
Range 725 km. (450 miles).



The KZ VII Lark Cabin Monoplane (125 h.p. Continental C125 engine).

FINLAND

EKLUND

TOROLF EKLUND.

HALLI, FINLAND.

Mr. T. Eklund, a Finnish aeronautical engineer, has designed in his spare time a small single-seat amphibian flying-boat which has been built in one of the State Metal Factories.

THE EKLUND TE-1.

The prototype TE-1 made its first flight on February 24, 1949, powered by a 25-28 h.p. Poinsard flat-twin engine. Because of crankcase failure and the impossibility of getting spares for this obsolete French engine, the TE-1 has been fitted with a 40 h.p. Continental A40 engine, and at the same time the following versions have been developed:—

TE-1A. Single-seat amphibian with retractable four-wheel landing-gear. May also be fitted with retractable skis.

TE-1B. Single-seat flying-boat.

From the latter the following versions will also be built:—

TE-1B-S. A flying-boat which may be equipped with fixed ski landing-gear or with beaching gear.

TE-1B-G. A flying-boat with wheel beaching-gear only.

TYPE.—Light Single-seat Cabin monoplane.

WINGS.—High-wing braced monoplane. NACA 4415 wing section. Aspect ratio 10. Incidence 7° constant. Dihedral 2°. Single-spar structure covered with plywood. Wings braced to hull by single steel-tube strut on each side. Front part of centre-section integral with hull. Rear part folds up to allow outer wing sections to fold back. Frise type ailerons covered with plywood. Adjustable trim-tab in right aileron. TE-1A fitted with landing flaps. Wing area 5.6 m.² (60 sq. ft.).

HULL.—Single-step type with Vee bottom. Plywood covered all-wood structure divided into five watertight compartments. Wing-tip floats of same structure as hull. Retractable water-rudder under tail.

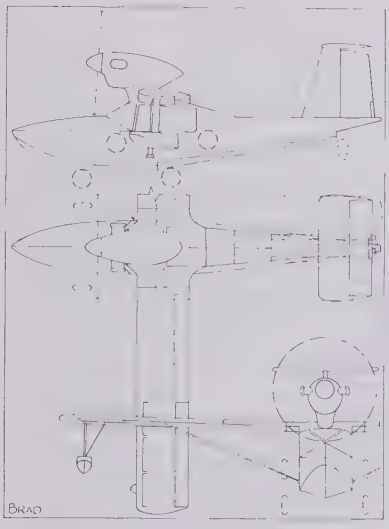
TAIL UNIT.—Fin integral with hull. One-piece tailplane attached to top of fin by three bolts. Wood frames with plywood covering. Adjustable tabs on elevator and rudder.

LANDING GEAR (TE-1A).—Retractable four-wheel type. Rubber-in-compression shock-absorber struts. Front wheels steerable. Mechanical retraction. May also be fitted with retractable skis. No landing-gear fittings on TE-1B. Fixed ski landing-gear may be fitted on TE-1B-S.



The prototype Eklund TE I (28 h.p. Poinsard engine).

POWER PLANT.—One 40 h.p. Continental A40-5 four-cylinder horizontally-opposed air-cooled engine in welded steel-tube nacelle attached to wing centre-section at three points. Fuel tank (10 U.S. gallons= 37.8 litres) in rear portion of nacelle behind fireproof bulkhead. Wood fixed-pitch airscrew. Any engine from 40 to 65 h.p. and from 41 to 77 kg. (90 to 170 lb.) weight may be fitted.



The Eklund TE IA Amphibian.

ACCOMMODATION.—One seat in enclosed crash-resistant cabin below wing. Seat built into aircraft's structure. Door in roof. Sides and front of cabin glazed with Plexiglas panels. Control by column and foot-pedals. Luggage compartment behind pilot.

DIMENSIONS.—Span 7.5 m. (24 ft. 7 in.).
Width folded 1.5 m. (4 ft. 11 in.).
Length 5.2 m. (17 ft. 1 in.).
Height (TE-1A) 1.9 m. (6 ft. 3 in.).
Height (TE-1B) 1.7 m. (5 ft. 7 in.).

WEIGHTS AND LOADINGS (TE-1A—designed).—
Weight empty 220 kg. (485 lb.).
Pilot 77 kg. (170 lb.).
Fuel and oil 30 kg. (67 lb.).
Baggage 8 kg. (18 lb.).
Weight loaded 335 kg. (740 lb.).
Wing loading 60 kg./m.² (12.3 lb./sq. ft.).
Power loading 8.4 kg./h.p. (18.5 lb./h.p.).

WEIGHTS AND LOADINGS (TE-1B designed).—
Weight empty 190 kg. (420 lb.).
Pilot 77 kg. (170 lb.).
Fuel and oil 30 kg. (67 lb.).
Baggage 18 kg. (38 lb.).
Weight loaded 315 kg. (695 lb.).
Wing loading 56.3 kg./m.² (11.6 lb./sq. ft.).
Power loading 7.9 kg./h.p. (17.4 lb./h.p.).

PERFORMANCE (TE-1A—estimated).—
Max. speed 155 km.h. (97 m.p.h.).
Cruising speed 135 km.h. (85 m.p.h.).
Landing speed 75 km.h. (47 m.p.h.).

PERFORMANCE (TE-1B—estimated).—
Max. speed 165 km.h. (103 m.p.h.).
Cruising speed 145 km.h. (90 m.p.h.).
Landing speed 85 km.h. (53 m.p.h.).

KARHUMÄKI

VELJEKSET KARHUMÄKI O/Y.

HEAD OFFICE AND WORKS: HALLI.
Managing Director: Niilo Karhumäki.
Technical Director: Olavi Raunio.

Veljekset Karhumäki O/Y was founded in 1924. The present factory was built in 1939-41 near the airfield of Halli.

At present the company is building training aircraft for the Finnish Air Force and the Karhu-48B monoplane described below.

THE KARHU 48B.

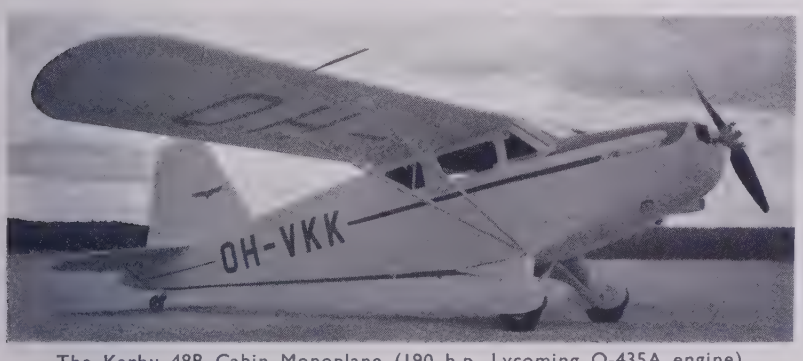
TYPE.—Four-seat Cabin monoplane.

WINGS.—High-wing rigidly braced monoplane. Wing braced by steel-tube vee struts. Two-spar wooden structure covered with fabric. Flaps and ailerons have welded steel-tube frames and fabric covering. Wing area 17.31 m.² (186.25 sq. ft.).

FUSELAGE.—Welded steel-tube structure covered with fabric.

TAIL UNIT.—Braced monoplane type. Welded steel-tube framework covered with fabric.

LANDING GEAR.—Tail-wheel type with interchangeable wheels and skis. Faired side vees, incorporating springing, and two half axles hinged at centre-line of underside of fuselage. Steerable tail-wheel. Landing-gear may be replaced by twin all-metal single-step floats of Karhumäki design and construction. Water-rudder on port float.



The Karhu 48B Cabin Monoplane (190 h.p. Lycoming O-435A engine).

POWER PLANT.—One 190 h.p. Lycoming O-435A six-cylinder horizontally-opposed air-cooled engine driving an Aeromatic 220 variable-pitch airscrew.

ACCOMMODATION.—Enclosed cabin seating four, two single-seats in front with removable dual controls and a full-width seat aft. Entrance door on each side. Two baggage compartments. Cabin heating and ventilation. Radio fitted as standard.

DIMENSIONS.—
Span 11.54 m. (37 ft. 10 in.).
Length (landplane) 7.85 m. (25 ft. 9 in.).
Length (seaplane) 8.10 m. (26 ft. 6½ in.).

WEIGHTS AND LOADINGS (Landplane).—
Weight empty 813 kg. (1,789 lb.).
Weight loaded 1,310 kg. (2,882 lb.).
Wing loading 75.7 kg./m.² (15.52 lb./sq. ft.).
Power loading 6.9 kg./h.p. (15.18 lb./h.p.).

WEIGHTS AND LOADINGS (Seaplane).—
Weight empty 905 kg. (1,991 lb.).
Weight loaded 1,400 kg. (3,080 lb.).
Wing loading 81 kg./m.² (16.60 lb./sq. ft.).
Power loading 7.4 kg./h.p. (16.28 lb./h.p.).

PERFORMANCE (Landplane).—
Max. speed 229 km.h. (142.2 m.p.h.).
Cruising speed 186 km.h. (115.5 m.p.h.).
Landing speed 78 km.h. (48.4 m.p.h.).
Service ceiling 4,800 m. (15,745 ft.).
Cruising range 700 km. (435 miles).

PERFORMANCE (Seaplane).—
Max. speed 203 km.h. (126 m.p.h.).
Cruising speed 176 km.h. (109.3 m.p.h.)
Alighting speed 83 km.h. (51.5 m.p.h.).
Service ceiling 4,200 m. (13,780 ft.).
Cruising range 650 km (404 miles).

VALMET

VALMET OY, LENTOKONETEHDAS (Aircraft Factory).

HEAD OFFICE AND WORKS: TAMPERE.

The Aircraft Factory forms part of the concern known as the State Metal Works, which was established after the war by bringing the former State Aircraft Factory and several other State-owned metal-working factories under a central management. The present Aircraft Factory, a direct continuation of the former State Aircraft Factory, consist of three branches with the Tampere Factory as the central unit. The Linnavuori Factory at Siuro produces chiefly engines, and the Kuorevesi Factory is, for the time being, responsible for aircraft repairs.

The original State Aircraft Factory (Valtion Lentokonetehdas) supplied the Air Force with various types of military aircraft. The Factory-designed Tuisku and Viima II training biplanes and the Pyry advanced training monoplane have been fully illustrated and described in previous issues of this Annual.

During the war the Myrsky, a single-seat fighter monoplane fitted with a Pratt & Whitney Twin-Wasp engine, and the Pyörremyrsky single-seat fighter fitted with a 1,475 h.p. Daimler-Benz DB 605AC inverted Vee liquid-cooled engine were built. The prototype of the latter first flew in 1945 but no production was undertaken.

The most recent production is the Vihuri, a two-seat advanced training monoplane. The prototype VH-1 flew for the first time on February 6, 1951. The Vihuri is going into production for the Finnish Air Force in a slightly modified form as the VH-II and the description and specification below applies to this latter model.

Owing to the scarcity of work in aircraft manufacture since the war the Aircraft Factories have now undertaken the production of various products in the metal-working industry.

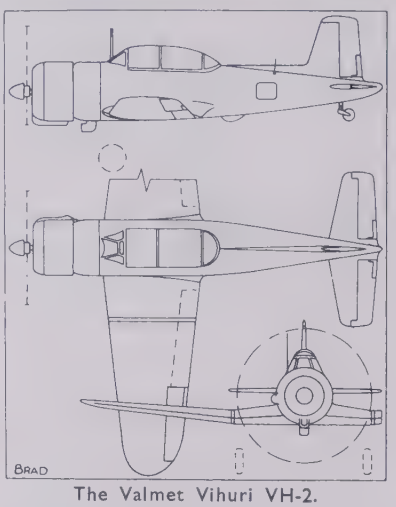
THE VALMET VH-II VIHURI (SQUALL).

TYPE.—Two-seat Advanced Trainer.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 0019-64 (root), NACA 23009 (tip). Aspect ratio 5.7. Chord 2.49 m. (7 ft. 7 in.) at root, 1.2 m. (3 ft. 8 in.) at tip. Dihedral (outer wings) 5°. Incidence (at root chord) 3°. Sweepback 4° at 25% chord. Light alloy stressed-skin structure. Modified Frise-type ailerons have light-alloy frames and fabric covering. Light alloy split flaps inboard of ailerons. Total area of ailerons 1.46 m.² (15.7 sq. ft.). Total area of flaps 1.85 m.² (19.9 sq. ft.). Gross wing area 18.86 m.² (202.9 sq. ft.).



The prototype Valmet Vihuri VH-I Two-seat Advanced Trainer.



The Valmet Vihuri VH-2.

FUSELAGE.—Forward section of fuselage is a welded chrome-molybdenum steel tube structure with Alclad covering. Rear section is a light metal stressed-skin monocoque.

TAIL UNIT.—Light alloy stressed-skin structure. Areas: fin 2.61 m.² (28.0 sq. ft.), rudder 0.82 m.² (8.8 sq. ft.), tailplane 2.79 m.² (20.0 sq. ft.), elevators (total) 1.21 m.² (13.0 sq. ft.). Tailplane span 3.74 m. (12 ft. 3 in.).

LANDING GEAR.—Retractable tail-wheel type. Hydraulic retraction. Valmet oil/spring shock-absorbers. Valmet wheels, Dunlop tyres and Valmet hydraulic brakes. Track 2.64 m. (8 ft. 8 in.).

POWER PLANT.—One 830 h.p. Bristol Mercury VIII nine-cylinder radial air-cooled engine on steel tube mounting. Modified three-blade D.H. constant-speed metal airscrew. Two main rubber bag tanks (190 litres = 41.6 Imp. gallons each) and two auxiliary tanks (125 litres = 27.4 Imp. gallons each) in centre-section. Total fuel capacity 630 litres (138 Imp. gallons). Oil capacity 30 litres (6.5 Imp. gallons).

ACCOMMODATION.—Enclosed cockpit seating two in tandem (pupil in front) with dual controls. Sliding jettisonable Perspex canopy. Seats and rudder-pedals are adjustable. Provision for amber screening for blind-flying training. 24-volt electrical system. VHF transmitter/receiver, with blind-approach equipment and radio compass.

DIMENSIONS.—
- Span 10.4 m. (33 ft. 1 in.).
- Length 8.8 m. (28 ft. 9 in.).
- Height 3.86 m. (12 ft. 8 in.).

WEIGHTS AND LOADINGS.—
- Max. loaded weight (normal fuel 2,632) kg. (5,790 lb.).
- Max. loaded weight (with auxiliary fuel) 2,817 kg. (6,197 lb.).
- Wing loading (normal fuel) 128.9 kg./m.² (26.42 lb./sq. ft.).
- Power loading (normal fuel) 3.17 kg./h.p. (6.97 lb./h.p.).

PERFORMANCE (at 2,632 kg. = 5,790 lb. A.U.W.) (Estimated).—
- Max. speed 445 km.h. (276 m.p.h.) at 3,700 m. (12,140 ft.).
- Econ. cruising speed 325 km.h. (202 m.p.h.) at 1,000 m. (3,280 ft.).
- Landing speed 140 km.h. (89 m.p.h.).
- Initial rate of climb 570 m./min. (1,870 ft./min.).
- Rate of climb at 3,700 m. (12,140 ft.) 510 m./min. (1,673 ft./min.).
- Service ceiling 8,500 m. (28,000 ft.).
- Take-off to 15.25 m. (50 ft.) 800 m. (875 yds.).
- Landing distance from 15.25 m. (50 ft.) 750 m. (820 yds.).

ADAM

ETABLISSEMENTS AÉRONAUTIQUES R. ADAM.

HEAD OFFICE AND WORKS: 85, RUE HOCHE, HOUILLES (SEINE-ET-OISE).

The Etablissements Aéronautiques Roger Adam specialises in the design of light aircraft suitable for the amateur pilot. It has built the RA-14 Loisirs; the higher-powered RA-15; and the RA-17, a single-seat development of the RA-15 intended for agricultural uses.

The company is, however, now concentrating its entire activities on the RA-14. This aircraft, of the simplest construction, is intended to be built by aero-clubs or private individuals, the company supplying all necessary drawings and fabricated parts and fittings at a third of the cost of a completed aircraft.



The Adam RA-14 Light Cabin Monoplane.

THE ADAM RA-14 LOISIRS.

TYPE.—Two-seat Light Cabin monoplane.

WINGS.—High-wing rigidly-braced monoplane. Two-spar wood structure covered with fabric. Steel-tube Vee bracing struts. Wings arranged to fold. Wing area 16 m.² (172 sq. ft.).

FUSELAGE.—Rectangular four-longeron structure covered with fabric.

TAIL UNIT.—Braced monoplane type. Wood frames, fabric covering.

LANDING GEAR.—Fixed divided type. Rubber-in-compression springing. Low-pressure wheels.

POWER PLANT.—Any engine of 40 to 65 h.p. A typical installation uses the 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine.

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Doors on each side of cabin.

DIMENSIONS.—
Span 10.9 m. (35 ft. 9 in.).
Length 7.0 m. (22 ft. 11 in.).
Height 2.2 m. (7 ft. 2½ in.).

WEIGHTS.—
Weight empty 280 kg. (616 lb.).
Weight loaded 480 kg. (1,056 lb.).

PERFORMANCE (65 h.p. Continental engine).—
Max. speed 140 km.h. (87 m.p.h.).
Landing speed 50 km.h. (31 m.p.h.).
Ceiling 4,000 m. (13,120 ft.).
Range 450 km. (280 miles).
Take-off run 100 m. (109 yds.).
Landing run 60 m. (66 yds.).

AUBERT

PAUL AUBERT.

ADDRESS: BUC AERODROME, NEAR VERSAILLES (SEINE-ET-OISE).

M. Paul Aubert, a pilot of the 1914-18 war, formed Aubert-Aviation in 1932 and in 1936 began the design of aircraft. The first aircraft he built was the PA-20 Cigale, a side-by-side trainer, which after successful trials, was exhibited at the 1938 Paris Salon.

In 1938 Aubert-Aviation became the Société Anonyme des Avions P. Aubert. Considerable sub-contract work was undertaken for the nationalised aircraft industry and a direct contract for a production of a number of Morane-Saulnier M.S. 230 trainers was placed with the company by the French Government. All this work ceased in June, 1940.

After the war Aubert revised the PA-20, the prototype of which had been destroyed during the occupation. In its revised form as the PA-201, and powered by a 140 h.p. Renault engine, it won many competitions.

The current development of this original design, the PA-204 Cigale-Major, flew in April, 1949 and received its Certificate of Airworthness in November, 1951.

Paul Aubert now occupies two hangars on Buc aerodrome, loaned to him by Blériot Aéronautique.



The Aubert PA-204 Cigale-Major Cabin Monoplane.

THE AUBERT PA-204 CIGALE-MAJOR.

TYPE.—Four-seat Touring monoplane.

WINGS.—High-wing cantilever monoplane. Aspect ratio 7.8. One-piece all-wood wing with elliptical outer sections. Entire trailing-edge hinged, outer sections as ailerons, inner sections as flaps. Gross wing area 12.92 m.² (139 sq. ft.).

FUSELAGE.—All-wood monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-wood structure. Adjustable tailplane. Areas: fin 0.59 m.² (6.35 sq. ft.), rudder 0.77 m.² (8.28 sq. ft.), tailplane 1.55 m.² (16.62 sq. ft.), elevators 1.65 m.² (17.75 sq. ft.). Tailplane span 3.80 m. (12 ft. 5½ in.).

LANDING GEAR.—Fixed tail-wheel type. Main cantilever legs are sprung within the fuselage by rubber blocks. Orientable tail-wheel. Track 2.80 m. (9 ft. 2 in.).

POWER PLANT.—One 140 h.p. Snecma Renault 4 Pei four-cylinder in-line inverted air-cooled engine. Two-blade Merville wood airscrew 2.03 m. (6 ft. 8 in.) in diameter. Two fuel tanks (75 litres = 16.5 Imp. gal. each) in wing, one on each side of fuselage.

ACCOMMODATION.—Enclosed cabin seating four in two pairs. Two upward-hinged doors, one on each side.

DIMENSIONS.—
Span 10.0 m. (32 ft. 9 in.).
Length 7.40 m. (24 ft. 3 in.).
Height 2.40 m. (7 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight empty 640 kg. (1,408 lb.).
Weight loaded 1,160 kg. (2,552 lb.).
Wing loading 90 kg./m.² (18.45 lb./sq. ft.).
Power loading 8.40 kg./h.p. (18.48 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 235 km.h. (146 m.p.h.).
Cruising speed 200 km.h. (124 m.p.h.).
Climb to 360 m. (1,180 ft.) 2 min. 15 sec.
Service ceiling 4,500 m. (14,760 ft.).
Cruising range 1,200 km. (745 miles).
Take-off distance to 20 m. (66 ft.) 550 m. (600 yds.).
Landing distance from 20 m. (66 ft.) 530 m. (560 yds.).

BÉARN

CONSTRUCTIONS AÉRONAUTIQUES DU BÉARN.

HEAD OFFICE: 32, AVENUE BIÉ-MOULIÉ, PAU (BASSES-PYRÉNÉES).

WORKS: PAU-IDRON AIRPORT.

Commercial Director: M. Laporte.

Technical Director: Y. Gardan.

This concern builds the Minicab two-seat light monoplane which, in 1949, won the Coupe de Deauville (1st in all categories), the Grand Prix Aérien de Vichy and the Concours d'Elégance de Biarritz. The prototype received its airworthiness certificate in April, 1949.

A series of ten Minicabs is being built for the Service de l'Aviation Legère et Sportive (S.A.L.S.).

The first of a new version of the Minicab fitted with a retractable landing-gear and powered with a 90 h.p. Continental engine will be completed in 1953. Six are being built, two for the S.A.L.S.

THE BÉARN MINICAB.

TYPE.—Two-seat Light monoplane.

WINGS.—Low-wing cantilever monoplane in one piece attached to fuselage by four bolts. One main and one auxiliary spar, girder ribs, plywood leading-edge and overall fabric covering. Slotted ailerons. Flaps between ailerons and fuselage. Wing area 10 m.² (107.6 sq. ft.).

FUSELAGE.—Wood framework with fabric covering.

TAIL UNIT.—Cantilever monoplane type. Fin integral with fuselage. One-piece tailplane with plywood covering attached to fuselage at four points. Wood framed fabric-covered one-piece elevator and rudder. Trim tabs in movable surfaces.

LANDING GEAR.—Fixed tail-wheel type. Cantilever main legs with rubber-block springing. Mechanical wheel brakes. Orientable tail wheel.

POWER PLANT.—One 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine driving a Merville two-blade wood airscrew 1.64 m. (5 ft. 4 in.) diameter. Fuel tank in fuselage. Fuel capacity 50 litres (11 Imp. gallons).

ACCOMMODATION.- Enclosed cabin seating two side-by-side with dual controls. One-piece Rhodoid windscreen may be jettisoned in emergency. Baggage compartment behind seats and accessible in flight.

DIMENSIONS.
Span 7.60 m. (24 ft. 11 in.).
Length 5.45 m. (17 ft. 10¼ in.).
Height 1.65 m. (5 ft. 5 in.).

WEIGHTS AND LOADINGS.-
Weight empty 265 kg. (583 lb.).
Fuel and oil 38.5 kg. (85 lb.).
Crew (2) with parachutes 166 kg. (365 lb.).
Baggage 10 kg. (22 lb.).
Weight loaded 480 kg. (1,056 lb.).
Wing loading 48 kg./m.² (9.84 lb./sq. ft.).
Power loading 7.4 kg./h.p. (16.28 lb./h.p.)

PERFORMANCE.—
Max. speed 198 km.h. (123 m.p.h.).
Cruising speed 180 km.h. (112 m.p.h.).
Landing speed 70 km.h. (43.5 m.p.h.).
Initial rate of climb 180 m./min. (590 ft./min.).
Climb 360 m. (1,180 ft.) 2 min. 10 sec.
Service ceiling 4,000 m. (13,120 ft.).



The Béarn Minicab (65 h.p. Continental A65 engine).

T.O. distance to 20 m. (66 ft.) 370 m. (405 yds.).
Landing distance from 20 m. (66 ft.) 343 m. (375 yds.).

THE BÉARN SUPER-MINICAB.

This is a development of the Minicab previously described. It will be fitted with a retractable landing-gear, slotted flaps and will be powered by a 90 h.p. Continental C90 flat-four engine.

DIMENSIONS.—
Span 8.10 m. (26 ft. 6 in.).
Length 5.60 m. (18 ft. 4 in.).

WEIGHT LOADED. –
550 kg. (1,210 lb.).

PERFORMANCE.—
Max. speed 265 km.h. (164.5 m.p.h.).
Cruising speed 230 km.h. (142.8 m.p.h.).
Landing speed 75 km.h. (46.5 m.p.h.).

BOISAVIA

AVIONS BOISAVIA.

HEAD OFFICE: 11, RUE PIERRE-BROSSOLETTE, IVRY-SUR-SEINE.

The principal product of Boisavia, which is under the direction of M. Lucien Tielès, is the B-60 Mercurey, a four-seat cabin monoplane which has been developed from the earlier B-50 Muscadet three-seater. A small series of the B-60 has been built, and several variants have been developed. These include the B-601, an agricultural version powered with the 190 h.p. Lycoming; the B-602, which is fitted with the 165 h.p. Continental engine; and the B-603, a glider-tug powered with the 240 h.p. Salmson-Argus As10 engine.

A new twin-engined monoplane, the B-260 Anjou, is under construction. Brief details appear below.

THE BOISAVIA B-260 ANJOU.

The B-260 is a twin-engined 4/5-seat monoplane of conventional layout. The prototype will be powered by two 135 h.p. D.H. Gipsy Major engines, but the 140 h.p. Snecma Renault 4 Pei or the 170 h.p. Regnier 4 L 02 engines are mentioned as possible alternatives.

The structure is mainly of metal with a welded steel-tube fuselage covered with fabric and a metal-framed monospar wing covered with metal forward of the spar and with fabric aft.

The constant-chord wing, which has an aspect ratio of 7.7, is fitted with wing fences and wing-tip "balonets" which have an aerodynamic function. They may ultimately be replaced by wing-tip tanks.

DIMENSIONS.
Span 12.85 m. (42 ft. 1 in.).



The Boisavia B-60 Mercurey (140 h.p. Renault engine).

Length 6.875 m. (22 ft. 6 in.).
Height 3.10 m. (10 ft. 2 in.).

WEIGHTS AND LOADINGS (Designed). —
Weight empty 855 kg. (1,880 lb.).
Weight loaded 1,550 kg. (3,410 lb.).
Wing loading 72 kg./m.² (14.76 lb./sq. ft.).
Power loading 5.74 kg./h.p. (12.62 lb./h.p.).

PERFORMANCE (D.H. Gipsy Major engines).—
Max. speed at S/L. 263 km.h. (163 m.p.h.).
Cruising speed at S/L. 238 km.h. (148 m.p.h.).
Cruising speed at 1,500 m. (4,920 ft.) 230 km.h. (143 m.p.h.).
Max. speed at S/L. on one engine 180 km.h. (112 m.p.h.).
Max. speed at 1,500 m. (4,920 ft.) on one engine 160 km.h. (100 m.p.h.).
Service ceiling 6,000 m. (19,680 ft.).

THE BOISAVIA B-60 MERCUREY.

TYPE.—Four-seat Cabin monoplane.

WINGS. — High-wing rigidly-braced monoplane. NACA 23.012 wing section. Two-spar wooden structure with stressed plywood skin. Vee bracing-struts. Slotted aerodynamically-balanced ailerons. Built-in leading-edge slots ahead of ailerons. Trailing-edge flaps between ailerons and fuselage. Wing area 18 m.² (193.6 sq. ft.).

FUSELAGE. — Welded steel-tube structure covered with fabric.

TAIL UNIT.—Cantilever monoplane type. Tailplane structure similar to that of wings. Balanced elevators and rudder. Trim-tabs, adjustable on ground, in port elevator and rudder.

LANDING GEAR.—Fixed type with divided axle. Differential wheel brakes. Steerable tail-wheel.

POWER PLANT.—One 140 h.p. Renault 4 Pei four-cylinder in-line inverted air-cooled engine driving a two-blade fixed-pitch airscrew. Alternative engines include the 165 h.p. Continental and 190 h.p. Lycoming flat-four power-units. Fuel tanks in wing roots.

ACCOMMODATION.—Cabin seats four in two pairs with dual controls to the front pair. One-piece windscreen, transparent roof and fairing over rear seats. Large door on each side opens upward for access to both front and rear seats. Baggage compartment at back of cabin accessible from inside. Soundproofing, heating and ventilation. Passenger seats quickly removable so that cabin may be used for light freight.

DIMENSIONS.—
Span 11.38 m. (37 ft. 4 in.).
Length 7.10 m. (23 ft. 3 in.).
Height 2.10 m. (6 ft. 10 in.).

WEIGHTS AND LOADINGS.—
Weight empty 520 kg. (1,444 lb.).
Weight loaded 1,000 kg. (2,200 lb).
Wing loading 55 kg./m² (11.27 lb./sq. ft.).
Power loading 7 kg./h.p. 15.4 lb./h.p.).

PERFORMANCE (140 h.p. Renault engine).—
Max. speed 235 km.h. (146 m.p.h.).
Cruising speed 190 km.h. (118 m.p.h.).
Landing speed 60 km.h. (37.2 m.p.h.).
Initial rate of climb 240 m./min. (790 ft./min.).
Ceiling 5,500 m. (18,040 ft.).
Range 1,100 km. (683 miles).
Take-off run 135 m. (147 yds.).
Landing run 60 m. (65 yds.).



The Boisavia B-603 Mercurey Glider-tug (240 h.p. Salmson engine).

THE BOISAVIA B-603 MERCUREY.

The B-603, powered by a 240 h.p. Salmson-Argus As10 engine, has been

developed specifically as a glider-tug. In official tests the B-603, towing a Nord 2000 glider, has taken off in 120 m. (393 ft.), climbed to 1,000 m. (3,280 ft.) in 3½ minutes and reached 5,600 m. (18,370 ft.) in 56 minutes.

PERFORMANCE.—
Max. speed 250 km.h. (155 m.p.h.).
Max. towing speed 110 km.h. (68.3 m.p.h.).
Service ceiling 7,000 m. (22,960 ft.).

BREGUET



The two prototypes of the Breguet Type 960 Vultur, one with wings folded.

SOCIÉTÉ ANONYME DES AVIONS LOUIS BREGUET.

HEAD OFFICE: 24, RUE GEORGES-BIZET, PARIS (XVIe).

WORKS: VILLACOUBLAY (SEINE-ET-OISE), TOULOUSE (HAUTE-GARONNE) AND BAYONNE (BASSES PYRÉNÉES).

Managing Director and Chief Engineer: Louis Breguet.

Managers: MM. J. de La Bruyère and Pierre Breguet.

The Breguet company was formed in 1911 by M. Louis Breguet, one of the great pioneers of French aviation.

Most of the former Breguet factories were incorporated into the nationalised industry in 1936, but in 1939 the Breguet company bought the Latécoère factories at Toulouse, Bayonne and Biscarosse.

In 1951 the company was engaged in the development and testing of the Type 96 Naval strike fighter, and the production of a series of fifteen Type 76 four-engined transports, of which the first will go into service with Air France and Air Algerie during 1952.

Development testing of the Type III Gyroplane continues, and the Breguet 900 sailplane is in production and is being delivered to various gliding centres.

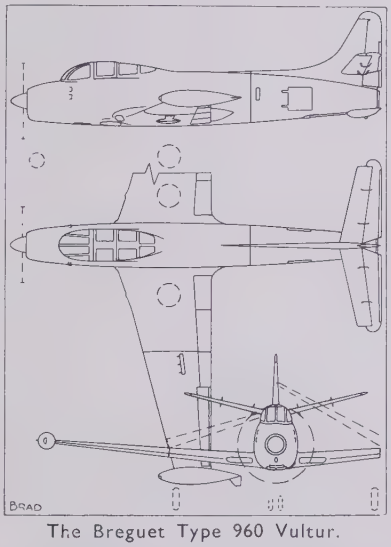
Breguet is developing a high-speed medium-range transport in accordance with a specification laid down by the Secretariat-General of Civil Aviation. Various design projects have been submitted for consideration under the designation Br. 978.

In 1952 the first Breguet feathering and reversing airscrews built under Rotol licence were completed and series production is being prepared.

In 1953 the company was engaged in the progressive testing of two Type 960 naval strike aircraft prototypes and was continuing with the production of the Type 763 Deux-Ponts, twelve of which are being delivered to Air France.

Two prototypes of the Type 901 high-performance sailplane, a development of the Type 900 which is in use at various gliding centres, were being built, and the company is engaged in the studies for a developed version of the Deux-Ponts, to be known as the Type 765, with "double-bubble" pressurised fuselage and a power-plant consisting of four 3,750 h.p. Wright Turbo-Cyclone engines.

Other activities include the manufacture of 200 Breguet-Rotol airscrews and the production of outer wings for the Nord 2501 transport.



The Breguet Type 960 Vultur.

THE BREGUET TYPE 960 VULTUR.

The Type 960 is a twin-engined two-seat Naval Strike aircraft with a composite turbojet-turboprop power-plant. It is a low-wing cantilever monoplane with retractable tricycle landing-gear and single-ruddered tail-unit. The crew of two is seated side-by-side and both members of the crew have ejection seats. The armament will consist of rockets, bombs and other special stores.

The power-plant consists of an Hispano-Suiza Nene turbojet in the rear fuselage and exhausting at the tail, and an Armstrong Siddeley Mamba turboprop in the nose. For normal cruising the Mamba engine will be used, the Nene being brought into use only for climb and combat.

The first of two 960 prototypes flew for the first time on August 3, 1951. The second prototype fitted with a higher-powered Mamba 3 engine made its first flight on September 15, 1952. This second prototype has undergone with success a special series of simulated deck-landing and catapulting trials at the Royal Aircraft Establishment, Farnborough, England under the control of the British Ministry of Supply.

No structural details of the Type 960 were available at the time of going to press.

DIMENSIONS.—
Span 18.70 m. (61 ft. 4 in.).
Length 15.35 m. (50 ft. 4 in.).
Height 5.17 m. (16 ft. 11 in.).
Wing area 36.55 m.² (393 sq. ft.).

WEIGHT LOADED.—
9,800 kg. (21,560 lb.).



The Breguet Type 960 Vultur (one Armstrong Siddeley Mamba turboprop and one Hispano-Suiza Nene turbojet).



The Breguet Type 763 Deux-Ponts Transport (four 2,400 h.p. Pratt & Whitney R-2800 CA18 engines).

PERFORMANCE.—
Max. speed (Mamba 3 only) 400 km.h. (248 m.p.h.).
Max. speed (Mamba+Nene) 850-900 km.h. (528-560 m.p.h.).
Deck-landing speed 155 km.h. (96 m.p.h.).
Ceiling 13,000 m. (42,640 ft.).
Endurance (Mamba 3 only) 4 hours 30 min.
Endurance (Mamba+Nene, at 700 km.h. =435 m.p.h.) 1 hour.

THE BREGUET TYPE 763 DEUX-PONTS.

The Breguet 763 is a development of the Type 761, the design of which, as a two-deck mixed transport of large capacity suitable for stage distances of the order of 2,000 km. (1,240 miles), was begun in 1944. The prototype 761 fitted with four 1,600 h.p. Snecma 14R engines flew for the first time on February 15, 1949. This aircraft, after completing its trials at the *Centre d' Essais en Vol* (C.E.V.) at Brétigny, was awarded a certificate of airworthiness at an all-up weight of 40,000 kg. (88,000 lb.).

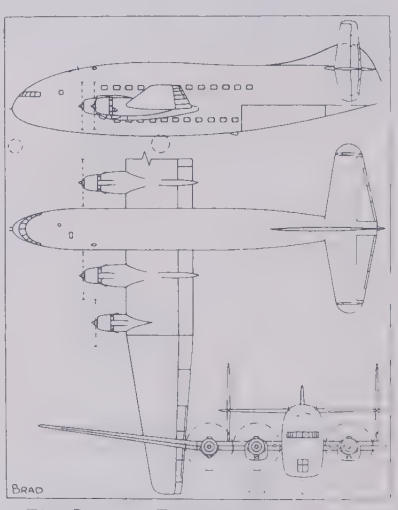
A pre-series of three aircraft, designated Type 761 S, was then put into production, the first making its first flight in 1951. These three aircraft are identical to the prototype except that they are powered with four 2,000 h.p. Pratt & Whitney R-2800 B31 engines driving Ratier reversible-pitch airscrews.

After the first Type 761 S had passed through the C.E.V. and had been awarded a C. of A. at a gross weight of 45,000 kg. (99,000 lb.), the second aircraft was handed over to Air Algérie in 1952 for operational trials between North Africa and France. In the course of these trials the aircraft, equipped as a freighter, flew a total of 600 hours carrying payload.

The three Type 761S aircraft were, at the time of writing, being fitted with their final furnishings for delivery to Air Algérie. They are being equipped to accommodate a total of 120 passengers in removable seats on both decks but can be adapted to carry mixed passengers and freight or all freight according to operational requirements.

The next twelve aircraft, known as the Type 763, were ordered by Air France in 1951. They are fitted with four 2,400 h.p. Pratt & Whitney R-2800 CA18 engines driving Hamilton Standard reversing airscrews, and have certain other modifications as compared with the Type 761 S, notably an increased wing span, certain structural reinforcements and a complete re-design of the flight compartment to meet Air France's request for the reduction of the flight crew from four to three.

The first Type 763 made its maiden flight on July 20, 1951, and after passing through the C.E.V. was awarded a C. of A. at a gross weight of 48,000 kg. (105,600 lb.). This figure has since been increased to 50,000 kg. (110,000 lb.) and will ultimately be raised to 52,000 kg. (114,400 lb.).



The Breguet Type 763 Deux-Ponts.

The second Type 763 began its service trials over Air France routes on August 20, 1952, and in 133 days it flew a total of 1,000 hours. The freight payload carried during these trials totalled 661,000 kg. (1,454,200 lb.), representing an average of 8,000 kg. (17,600 lb.) daily. The third and fourth Type 763's were delivered to Air France on February 27 and April 1, respectively and four more were due to be handed over during the remainder of 1953.

The Type 763, which is known by Air France as the "Provence," is equipped to accommodate 107 passengers, 59 "tourist" class on the upper deck and 48 second class on the lower deck. The lower deck can, however, be quickly adapted in whole or in part for the carriage of freight by folding the passenger seats against the cabin walls and, where both passengers and freight are carried, by inserting a removable bulkhead between the two compartments.

The Type 763 was the first French aircraft of post-war design to be ordered by Air France. Regular service was inaugurated on March 16, 1953, on the Lyon-Algiers route. The description which follows refers to the Type 763.

TYPE.—Four-engined Passenger or Freight Transport.

WINGS.—Cantilever mid-wing monoplane. Aspect ratio 9.95. Light alloy structure with stressed metal skin. Metal ailerons each in three-sections on outer wings. Area (each) 9.2 m.² (99 sq. ft.). Breguet slotted flaps in four sections each side between ailerons and fuselage. Pneumatic operation. Total flap area 27.51 m.² (296 sq. ft.). Gross wing area 185.4 m.² (1,996 sq. ft.).

FUSELAGE.—Two-deck monocoque in five main sections. Duralumin structure with



The Breguet Type 763 Deux-Ponts Transport (four 2,400 h.p. Pratt & Whitney R-2800 CA18 engines).



The Breguet Type 761S Deux-Ponts Transport (four 2,000 h.p. Pratt & Whitney R-2800 B31 engines).

stressed metal skin. Max. fuselage width 3.30 m. (10 ft. 9½ in.), max. depth 5.0 m. (16 ft. 5 in.).

TAIL UNIT.—All-metal cantilever structure consisting of tailplane and one-piece elevator mounted at top of fuselage and carrying twin fins and rudders inset from tips. Three trim and balance tabs in each surface. Total horizontal area 41.6 m.² (447.6 sq. ft.); total vertical area 19.16 m.² (206 sq. ft.).

LANDING GEAR.—Retractable tricycle type. Messier shock struts to all wheels. Twin main wheels, single nose wheel, hydraulic retraction. Track 7.98 m. (26 ft. 2 in.).

POWER PLANT.—Four 2,400 h.p. Pratt & Whitney R-2800 CA18 fourteen-cylinder two-row radial air-cooled engines, with water injection for take-off, driving Hamilton Standard three-blade constant-speed and reversing airscrews, 4.25 m. (13 ft. 11 in.) diameter. Total fuel capacity 15,300 litres (3,366 Imp. gallon); two 3,220 litre (708 Imp. gallon) tanks in outer wings; two 4,130 litre (908 Imp. gallon) tanks in centre-section and two 300 litres (66 Imp. gallon) reserve tanks one in each outer engine nacelle. Oil capacity 800 litres (173 Imp. gallons) in four tanks.

ACCOMMODATION.—Fuselage divided into two decks. Crew compartment in nose on upper deck with accommodation for three. The standard accommodation provides for the upper deck to seat 59 tourist passengers and the lower deck to seat 48 passengers. The upper deck also includes buffet to serve 59 passengers, seat for hostess and toilets fore and aft. The lower deck, which is provided with seats which may be folded against the walls, may be adapted in whole or in part for the carriage of freight. When both passengers and freight are carried removable bulkheads then separate the passenger accommodation from the rear fuselage. Toilet forward. Loading of freight hold through four large openable panels beneath rear fuselage, operated in pairs by hydraulic jacks. Side door on starboard side forward of wings for small freight. Normal access for passengers through lateral doors in closed freight-loading panels aft and then by staircase to upper deck. Volume of lower deck 80 m.³ (2,815 cub. ft.). Lower deck floor 1.40 m. (4 ft. 7 in.) from ground permitting direct loading from trucks.

DIMENSIONS.—
Span 42.96 m. (140 ft. 11 in.).
Length 28.94 m. (94 ft. 11 in.).
Height 9.56 m. (31 ft. 4 in.).

WEIGHTS.—
Weight empty 32,535 kg. (71,577 lb.).
Crew 360 kg. (792 lb.).
Fuel and oil 7,487 kg. (16,471 lb.).
Passengers (upper deck) 5,900 kg. (12,980 lb.).
Freight and baggage (lower deck) 3,718 kg. (8,180 lb.).
Max. take-off weight 50,000 kg. (111,000 lb.).
Max. landing weight 46,000 kg. (101,200 lb.).

PERFORMANCE.—
Max. cruising speed 390 km.h. (242 m.p.h.) at 3,050 m. (10,000 ft.).
Max. cruising speed 390 km.h. (242 m.p.h.) at 3,000 m. (9,840 ft.).
Economic cruising speed 336 km.h. (210 m.p.h.) at 3,000 m. (9,840 ft.).
Rate of climb at S/L. 350 m./min. (1,140 ft./min.).
Rate of climb at 2,300 m. (5,000 ft.) 270 m./min. (880 ft./min.).
Rate of climb at S/L. (on 3 engines) 150 m./min. (500 ft./min.).
Climb to 3,000 m. (9,840 ft.) 13 min.
Take-off run to clear 15 m. (50 ft.) 1,260 m. (1,378 yds.).
Landing distance from 15 m. (50 ft.) 980 m. (1,072 yds.).
Max. range (15 km.p.h. headwind—with usual fuel reserves—max. cruising speed) 2,050 km. (1,280 miles).
Max. range (as above—at economic cruising speed) 2,290 km. (1,430 miles).

THE BREGUET TYPE 900.

The Type 900 sailplane was built in the Toulouse factory of the Breguet company and on its maiden flight on May 13, 1949, it made a flight of 470 km. (292 miles) at an average speed of 90 km.h. (56 m.p.h.) which, if observed, would have established a new French goal flight record. The Type 900, after approval by the *Centre d'Essais en Vol* at Brétigny, is now in production.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Shoulder-wing cantilever monoplane. Aspect ratio 15.85. Single spruce and plywood spar with D-nose of plywood and overall fabric covering. Slotted ailerons, with 25° upward and 15° downward movement, on outer halves of each half span, with slotted flaps, with 40° downward movement, inboard. Metal dive brakes on upper and lower surfaces. Gross wing area 12.9 m.² (138.8 sq. ft.).

FUSELAGE.—Wood structure with plywood skin. Fin integral with rear fuselage.

TAIL UNIT.—Cantilever monoplane type.

LANDING GEAR. Single skid, followed by single Messier wheel with brake, and sprung tail-skid aft.

ACCOMMODATION.—Single enclosed cockpit. Provision for back-type parachute.

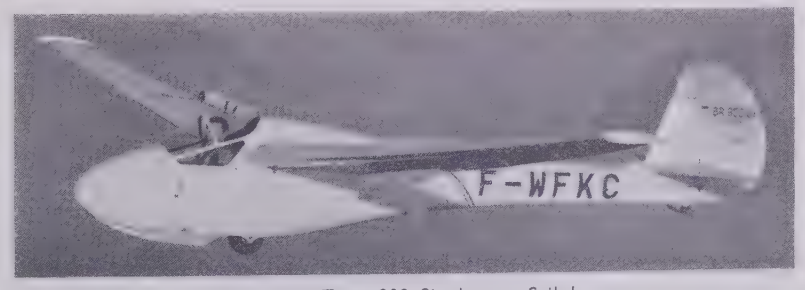
DIMENSIONS.—
Span 14.30 m. (46 ft. 11 in.).
Length 6.50 m. (21 ft. 4 in.).

WEIGHTS.—
Weight empty 200 kg. (440 lb.).
Weight loaded 290 kg. (638 lb.).

PERFORMANCE —
Max. speed 72 km.h. (44.7 m.p.h.).
Sinking speed at 100 km.h. (62 m.p.h.) 1.50 m./sec. (4.9 ft./sec.).
Min. sinking speed 0.70 m./sec. (2.3 ft./sec.).

THE BREGUET TYPE 901.

Two prototypes are being built of the Type 901, a high-performance development of the Type 900. The Type 901 will be fitted with a new laminar-flow (NACA 63 Series) wing of 17.30 m. (56 ft. 9 in.) span and with an area of 15 m.² (161.4 sq. ft.) and an aspect ratio of 20. The loaded weight will be approximately the same as that of the Type 900, giving a wing loading of about 20 kg./m.² (4.1 lb./sq. ft.). No further details were available at the time of writing.



The Breguet Type 900 Single-seat Sailplane.

BROCHET

AVIONS MAURICE BROCHET.

HEAD OFFICE AND WORKS: 12 RUE SAINT-MARTIN, NEAUPHLÉ-LE-CHATEAU (S.-ET-O.).

M. Maurice Brochet specialises in the design of light aircraft for the amateur constructor. His designs are conceived with the greatest simplicity so that, with the aid of a complete set of working drawings, they may be built by private individuals, aero-clubs, etc., with the simplest of equipment and materials.

Of the latest Brochet aircraft, ten M.B. 70's have been delivered to the Service de

l'Aviation Legère et Sportive, and ten M.B. 80's, five M.B. 100's and fifteen M.B. 101's are being built for the same official body for distribution among French flying clubs. The first production M.B. 100 flew for the first time on March 25, 1953.

THE BROCHET M.B. 70.

TYPE.- Two-seat Light Cabin monoplane.
WINGS.- High-wing braced monoplane. Two-spar wood structure covered with fabric. Vee bracing struts. Wing area 14 m.² (151 sq. ft.).
FUSELAGE.- Rectangular wood structure.
TAIL UNIT.—Cantilever monoplane type. Wood framework covered with fabric.
LANDING GEAR.—Fixed type. Two faired side Vees and two half axles, the latter hinged to a tubular Vee cabane beneath the fuselage. Rubber cord shock-absorbers. Lockheed wheel brakes. Solid rubber tail-wheel interconnected with rudder-bar.
POWER PLANT.— One 45 h.p. Salmson 9ADB nine-cylinder radial air-cooled engine. Two wing fuel tanks with a total capacity of 70 litres (15.5 gallons).
ACCOMMODATION.—Enclosed cabin seating two in tandem with dual controls. Upward-opening door on each side.
DIMENSIONS.—
Span 10.35 m. (34 ft. 6 in.).
Length 6.50 m. (21 ft. 4 in.).

THE BROCHET M.B. 71.

The M.B. 71 is similar to the M.B. 70 except that it is fitted with a 75 h.p. Minié 4.DC.32 flat-four engine. The total fuel capacity is increased to 80 litres (18 Imp. gallons).
DIMENSIONS.
Same as M.B. 70.
WEIGHTS.-
Weight empty 347 kg. (763 lb.).
Weight loaded 550 kg. (1,210 lb.).
PERFORMANCE.—
Max. speed 163 km.h. (101 m.p.h.).
Cruising speed 145 km.h. (90 m.p.h.).
Initial rate of climb 240 m./min. (787 ft./min.).
Climb to 350 m. (1,150 ft.) 2 min. 20 sec.

THE BROCHET M.B. 80.

The M.B. 80 is a development of the M.B. 71. The fuselage is 10.2 cm. (4 in.) wider, all control surfaces are balanced, the landing-gear is of the steel spring type as fitted to the M.B. 100 and the engine is a 75 h.p. Minié 4DC.32B flat-four.

A series of ten is being built for the S.A.L.S.

THE BROCHET M.B. 100.

The M.B. 100 is a three-seat development of the M.B. 70. The cabin seats two side-by-side with dual controls in front, with the third seat centrally-placed behind.

The M.B. 100, which is not intended for the amateur constructor, has a steel tube fuselage and a Cessna-type spring steel cantilever landing-gear. It is powered with a 91 h.p. 504 four-cylinder in-line inverted air-cooled engine.
DIMENSIONS.
Span 10.66 m. (34 ft. 11 in.).
Length 6.50 m. (21 ft. 4 in.).
Wing area 14.23 m.² (153 sq. ft.).
Height 2.0 m. (6 ft. 7 in.).



The Brochet M.B. 71 (75 h.p. Minié 4.DC.32 engine).


The Brochet M.B. 100 (90 h.p. Hirth 504 engine).


The Brochet M.B. 80 (75 h.p. Minié 4.DC.32B engine).

C.F.A.

COMPAGNIE FRANÇAISE D'AVIATION.

HEAD OFFICE AND WORKS: 128 RUE DE SILLY, BILLANCOURT (SEINE).

The Compagnie Française d'Aviation was formed before the war, in association with the Société des Moteurs Salmson to build the Salmson Cri-Cri two-seat training monoplane which was produced in large numbers for the then officially-sponsored "Aviation Populaire" movement.

The first post-war product of the company was the Cri-Cri Major. This was superseded in 1950 by the Phryganet which, in turn, have been followed by the Phrygane and the Super-Phrygane. All these aircraft have been designed by M. P. J. Deville.

THE C.F.A. SUPER PHRYGANE.

TYPE.- Four-seat Touring and Training monoplane.
WEIGHTS AND LOADINGS.
Weight empty 465 kg. (1,023 lb.).
Weight loaded 780 kg. (1,716 lb.).
Wing loading 54 kg./m.² (11 lb./sq. ft.).
Power loading 8.66 kg./h.p. (18 lb./h.p.).
PERFORMANCE.
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 165 km.h. (102.4 m.p.h.).
Landing speed 55 km.h. (34 m.p.h.).
Rate of climb 180 m./min. (590 ft./min.).
Service ceiling 3,500 m. (11,480 ft.).
T.O. run 180 m. (196 yds.).
Landing run 160 m. (175 yds.).
Range 600 km. (375 miles).

WINGS. High-wing braced monoplane. Two-spar wooden structure. Steel tube Vee bracing struts. Wing area 22.50 m.² (241 sq. ft.).

THE BROCHET M.B. 101.

The M.B. 101 differs from the M.B. 100 by having an air filter and suitable external finish for service in North Africa. Fifteen are being built for the S.A.L.S. for use in schools in North Africa.

FUSELAGE.—Rectangular wood structure built up of four longerons, cross members and a plywood skin.
TAIL UNIT.- Braced monoplane type. Tail-


The C.F.A. Super Phrygane (135 h.p. Salmson 7AQ engine).

plane, fin, elevators and rudder have wood frames and fabric covering.

LANDING GEAR.—Split type. Consists of two long stroke oleo-pneumatic shock-absorber legs, the upper ends of which are attached to the upper fuselage longerons and the lower ends hinged to the centre-line of the underside of the fuselage by steel-tube Vee axles. Low-pressure wheels. Lockheed brakes. Steerable tail-wheel.

POWER PLANT.—One 135 h.p. Salmson 7AQ seven-cylinder air-cooled radial engine on hinged steel-tube mounting and enclosed in low-drag cowling. Two fuel tanks, one in each wing root. Hand-electric starter.

ACCOMMODATION.—Enclosed cabin seating four in two pairs the front pair with dual controls. Two doors on each side of cabin. Baggage compartment behind rear seats. Equipment includes radio, night-flying equipment, etc.

DIMENSIONS.—
Span 11.80 m. (38 ft. 8 in.).
Length 7.90 m. (25 ft. 11 in.).
Height 2.32 m. (7 ft. 7 in.).

WEIGHTS AND LOADINGS.—
Weight empty 780 kg. (1,716 lb.).
Crew (four) 300 kg. (660 lb.).
Fuel and oil 133 kg. (292 lb.).
Baggage 37 kg. (82 lb.).
Weight loaded 1,250 kg. (2,750 lb.).
Wing loading 55.5 kg./m.² (11.4 lb./sq. ft.).
Power loading 9.6 kg./h.p. (21.1 lb./h.p.).

PERFORMANCE.—
Max. speed 215 km.h. (134 m.p.h.).
Cruising speed 190 km.h. (120 m.p.h.).
Service ceiling 4,300 m. (14,300 ft.).
Take-off run 140 m. (155 yds.).
Landing run 130 m. (143 yds.).
Range 800 km. (500 miles).

THE C.F.A. PHRYGANE.

The Phrygane is generally similar to the Super Phrygane previously described, but is powered by the 135 h.p. Salmson 9NC nine-cylinder radial air-cooled engine, and there are one or two other minor differences.

DIMENSIONS.—
Span 11.70 m. (38 ft. 4 in.).
Length 7.85 m. (25 ft. 9 in.).
Height 2.40 m. (7 ft. 10 in.).

WEIGHTS.—
Weight empty 700 kg. (1,540 lb.).
Crew (4) 240 kg. (528 lb.).
Fuel and oil 130 kg. (286 lb.).
Baggage 45 kg. (99 lb.).
Weight loaded 1,115 kg. (2,453 lb.).

PERFORMANCE.—
Max. speed 205 km.h. (127 m.p.h.).
Cruising speed 180 km.h. (112 m.p.h.).
Climb to 360 m. (1,180 ft.) 2 min. 36 sec.
Service ceiling 4,300 m. (14,100 ft.).
Range 800 km. (500 miles).
Take-off run 120 m. (131 yds.).
Landing run 110 m. (120 yds.).

DASSAULT



The three prototypes of the Dassault M.D.450 Ouragan Single-seat Interceptor Fighter.

AVIONS MARCEL DASSAULT.

HEAD OFFICE: 46, AVENUE KLÉBER, PARIS (16e).

WORKS: SAINT CLOUD (SEINE), ARGENTEUIL (S-ET-O), VILLAROCHE (S-ET-O), BOULOGNE (SEINE), MERIGNAC (GIRONDE), TALENCE (GIRONDE) AND CASARLANCA (MAROC).

Avions Marcel Dassault, formerly the Société des Avions Marcel Bloch, is engaged in the development and production of military aircraft.

The Company's principal current productions are the M.D. 450 Ouragan, the M.D. 452 Mystère II, the Mystère IV, and the M.D. 315 and 316.

The M.D. 450 Ouragan has been in production for the French Air Force since 1951. The order for 325 was due for completion in the Summer of 1953. In addition, the Indian Government has ordered 71 Ouragans for the Indian Air Force.

The Mystère II is in production for the French Air Force and the Mystère IV is the subject of a large "off shore" order placed by the U.S. Government under the N.A.T.O. joint aircraft programme. The Mystère IV has also been ordered in quantity by the French Government.

Series production of these aircraft is being undertaken under a widespread sub-contracting programme, with the final assembly and flight testing being handled by Dassault. The total employment of the Dassault factories is only 3,000, while some 25,000 employees of other concerns all over France are engaged in the production of Dassault parts and sub-assemblies.

In 1953 Avions Marcel Dassault acquired the manufacturing licence of the Viper turbojet engine from Armstrong Siddeley Motors, Ltd.

Avions Marcel Dassault is also engaged in the development and manufacture of both electric and hydraulic quick-feathering and reversing airscrews.

THE DASSAULT M.D.550.

The M.D. 550 is a delta-wing research aircraft which is under development. It is believed that the licence for the Armstrong Siddeley Viper engine, which was acquired by Dassault in 1953, has some connection with this project. No details of the aircraft are available.

THE DASSAULT M.D.450 OURAGAN (HURRICANE).

The M.D.450 was the first French jet-propelled fighter to be ordered in quantity by the French Air Force and its evolution established a notable record in speed of design and construction. The design, to an official interceptor fighter specification, was begun in December, 1947, the official order for three prototypes was given on July 1, 1948, and the first prototype flew for the first time on February 28, 1949.

After very successful tests a pre-production order for twenty-five was placed and the first aircraft of this series flew at the end of November, 1950.

The M.D.450, powered with the Hispano Suiza Nene engine is now in large-scale production with some thirty-five per cent. of the total production being sub-contracted to the S.N.C.A.S.O. and S.N.C.A.S.E. Production had reached thirty per month by January, 1953.

TYPE.—Single-seat Interceptor Fighter.

WINGS.—Low-wing cantilever monoplane. Symmetrical laminar-flow section with maximum thickness at 45% of chord. Leading-edge swept back at 20°, trailing-edge straight. Dihedral 5°. Aspect ratio 6. Two-spar all-metal structure. Slotted ailerons. Split flaps between ailerons and fuselage. Wing area 25 m.² (269 sq. ft.)



A production Dassault M.D.450 Ouragan Single-seat Fighter (Hispano-Suiza Nene turbojet engine).



The Dassault M.D. 452 Mystère II Swept-wing Fighter (Hispano-Suiza Tay turbojet engine).

FUSELAGE.—Circular all-metal structure in three detachable sections. Nose section has an inner "nacelle" which divides the air flow to the engine plenum chamber. This nacelle contains the pilot's cockpit and the nose wheel compartment. Centre section has the built-in wing attachments and engine mounting fittings. Radio equipment and fuselage fuel tanks are located between air ducts. Rear fuselage section encloses engine tail-pipe and carries tail-unit. Hydraulically-operated air-brakes on sides of rear fuselage between wings and tail.

TAIL UNIT.—Cantilever monoplane type with tailplane mounted one-third up fin. 5° dihedral on tailplane. Two-spar fin and tailplane. Trim-tabs in rudder and elevators.

LANDING GEAR. Messier retractable nose-wheel type. Main wheels raised inward, nose wheel forward. Hydraulic retraction with electric control. Emergency hand pump.

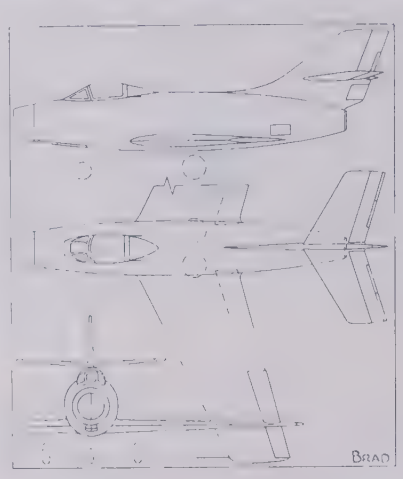
POWER PLANT.— One Hispano-Suiza Nene 102 centrifugal-flow turbojet engine (2,250 kg.= 5,000 lb. s.t.) in centre fuselage with nose air-entry and tail jet exit. Fuel tanks in fuselage centre-section and in wings outboard of landing-gear. Wing-tip tanks for long-range.

ACCOMMODATION.- Pressurised cockpit with fixed bullet-proof screen and sliding jettisonable canopy. Martin-Baker ejector seat. Armour fore and aft of pilot.

ARMAMENT. –Four 20 mm cannon in fuselage nose. Provision for sixteen rockets under wings.

DIMENSIONS.-
Span 12.17 m. (39 ft. 11 in.).
Length 10.70 m. (35 ft.).
Height 4.00 m. (13 ft. 1 in.).

WEIGHTS.—
Weight empty 3,960 kg. (8,732 lb.).
Weight loaded 5,300 kg. (11,660 lb.).



The Dassault M.D. 452 Mystère II.

PERFORMANCE.—
Max. speed at S/L. 960 km.h. (600 m.p.h.).
Speed at 9,000 m. (29,520 ft.) 856 km.h. (532 m.p.h.).
Rate of climb at S/L. 2,580 m./min. (8,460 ft./min.).
Rate of climb at 9,000 m. (29,520 ft.) 1,080 m./min. (3,550 ft./min.).
Take-off run 600 m. (656 yds.).
Take-off to 15 m. (50 ft.) 790 m. (856 yds.).
Landing from 15 m. (50 ft.) 910 m. (995 yds.).

THE DASSAULT M.D. 452 MYSTÈRE II.

The M.D.452 is a swept-wing version of the M.D. 450. The first of four prototypes, powered with an Hispano-Suiza Nene engine, made its first flight on February 23, 1951.

A pre-production series of twenty-one aircraft are being fitted with the Hispano-Suiza Tay (2,850 kg.=6,270 kg. s.t.) and with later versions of the Snecma Atar 101, which are expected to develop from 2,800-3,000 kg. (6,160-6,600 lb.) s.t.

One of the pre series Mystère II aircraft powered by an Hispano-Suiza Tay engine and fully armed with four 20 mm. cannon, exceeded Mach 1 on October 28, 1952, the first French aircraft to do so. It was flown by an American pilot and exceeded the speed of sound during comparative diving trials with a North American F-86 Sabre at Melun-Villaroche.

The Mystère has been ordered in a substantial quantity for the French Air Force.

The production Mystère II will be fitted with two Snecma Atar 101C turbojet engines (2,850 kg.=6,280 lb. s.t.) and the first aircraft is expected to come off the assembly line in April, 1954. The armament will consist of two 30 mm. cannon with radar range-finding equipment.

No further details of the Mystère II are available.

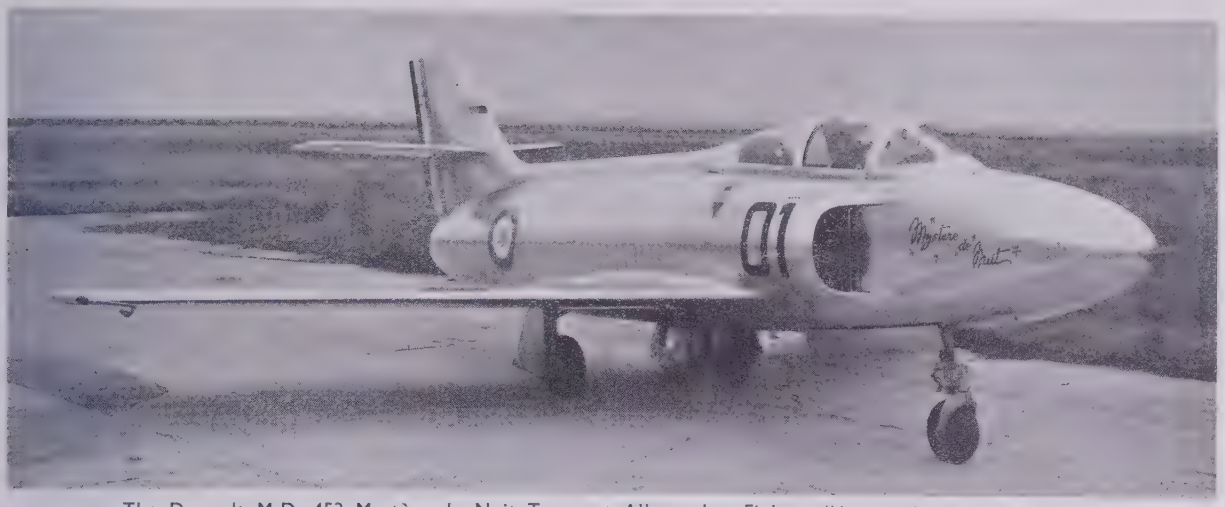
DIMENSIONS.—
Span 11.62 m. (38 ft. 1 in.).
Length 11.68 m. (38 ft. 4 in.).

WEIGHT LOADED.—
6,510 kg. (14,330 lb.).

PERFORMANCE.—
Max. speed 1,075 km.h. (671 m.p.h.).
Rate of climb 2,880 m./min. (9,450 ft./min.).
Service ceiling 18,010 m. (59,050 ft.).



The Dassault Mystère IV Swept-wing Fighter (Hispano-Suiza Tay turbojet engine).



The Dassault M.D. 453 Mystère de Nuit Two-seat All-weather Fighter (Hispano-Suiza Nene turbojet engine).

THE DASSAULT MYSTÈRE IV.

Although generally similar in general outline to the Mystère II, the Mystère IV is a completely new aircraft. The wings have increased sweep and are of a relatively thinner wing section. The Mystère IV will have the heavier 30 mm. cannon armament.

The standard power-plant of the Mystère IVA is the Hispano-Suiza Tay turbojet (2,850 kg.=6,270 lb. s.t.) and provision is made for the fitting of an Hispano-Suiza afterburner. The Mystère IVB will be powered with the Hispano-Suiza Avon turbojet.

Eighteen pre-production aircraft have been ordered by the French Government, ten fitted with the Hispano-Suiza Tay and eight with either Snecma Atar 101 or Hispano-Suiza Avon engines. Two of the Atar-engined aircraft will be equipped as night fighters.

No further details of the Mystère IV are available for publication.

THE DASSAULT M.D.453 MYSTÈRE DE NUIT.

The M.D.453 is a two-seat all-weather fighter version of the M.D.452. In order to accommodate the necessary radar equipment in the nose of the fuselage this aircraft has the air inlets in the sides of the fuselage. The prototype flew for the first time on July 18, 1952. No further details are available.

THE DASSAULT M.D.316.

The M.D.316 is a development of the M.D.315 for military and civil transport duties.

The first prototype is a military version which may be used for light communications with accommodation for six passengers and freight, or as a trainer for pilots and navigators. This version is fitted with two 800 h.p. Snecma 14X radial air-cooled engines.

A second prototype, the M.D. 316T, is powered by two 800 h.p. Wright C7BA1 engines and can be equipped as a civil transport with accommodation for 10-15 passengers. This version is fitted with a single-ruddered tail-unit.

No further details of these two aircraft are available.

THE DASSAULT M.D.315 FLAMANT.

The M.D.315 conforms to a French specification for a light general purpose aircraft for service mainly in territories of the French Union. Successful in competitive trials at the *Centre d'Essais en Vol* at Brétigny in 1947, the M.D.315 was ordered in quantity in 1947 and 1948. Delivery is now complete.



The Dassault M.D. 316 Military Transport (two 800 h.p. Snecma 14X engines).

TYPE.—Twin-engined Light Military Transport and Colonial Liaison monoplane.

WINGS.—Low-wing cantilever monoplane. Flat centre-section, outer sections at 8° dihedral. Aspect ratio 8.9 Two-spar all-metal structure. Trailing-edge flaps inboard of ailerons, each flap in two sections. Wing area 47.2 m.² (508 sq. ft.).

FUSELAGE.—Oval section all-metal stressed-skin structure.

TAIL UNIT.—Cantilever monoplane type with



A line of Dassault M.D. 315 Light Transports of the French Air Force.

twin fins and rudders. Tailplane has 8° dihedral angle. Automatic and controllable trim-tabs in elevators.

LANDING GEAR.—Messier retractable tricycle type. Main wheels retract into tails of engine nacelles, nose-wheel into fuselage. Steerable nose-wheel with centre-lock. Messier wheel brakes.

POWER PLANT.—Two 580 h.p. Renault 12S 02-201 twelve-cylinder inverted Vee air-cooled engines driving Dassault three-blade feathering and reversible airscrews.

ACCOMMODATION.—Crew of two side-by-side in crew compartment. Cabin may seat up to ten passengers in removable seats. Toilet compartment aft of cabin. Large door on starboard side of cabin. Interior may be arranged as ambulance or for use as light freight transport.

DIMENSIONS.—
Span 20.70 m. (67 ft. 10 in.).
Length 12.50 m. (41 ft.).
Height 4.50 m. (14 ft. 9 in.).

WEIGHTS.—
Weight empty 4,250 kg. (9,350 lb.).
Weight loaded 5,800 kg. (12,760 lb.).

PERFORMANCE.—
Max. speed 380 km.h. (236 m.p.h.).
Cruising speed 300 km.h. (186.3 m.p.h.).
Landing speed 95 km.h. (59 m.p.h.).
Initial rate of climb 300 m./min. (985 ft./min.).
Service ceiling 8,000 m. (26,240 ft.).
Take-off run 260 m. (285 yds.).
Take-off distance to 15 m. (50 ft.) 460 m. (503 yds.).
Range 1,200 km. (745 miles).

THE DASSAULT M.D.311 and M.D.312.

These two aircraft are variants of the M.D.315 and were ordered by the French Air Force. They were produced on the same production lines as the M.D.315.

The M.D.311 is equipped as a trainer for bombing, navigation and photography, and the M.D.312 is furnished as a six-passenger military liaison monoplane. Except for the minor changes necessary to adapt them to their specialised duties these two aircraft are of the same general construction as and have similar performance characteristics to those of the M.D. 315, previously described.

DRUINE

ROGER DRUINE.

ADDRESS: BOITE POSTALE 138, CHOLET (M-ET-L).

M. Roger Druine is a young man of thirty years of age who built his first aeroplane fifteen years ago. His two most recent products are the Turbulent single-seat monoplane and the Turbi, a two-seat version of the Turbulent. At the time of writing sixty-nine constructional kits of the single-seat Turbulent had been sold in less than a year to amateur constructors.

THE DRUINE TURBULENT.

The Turbulent is a conventional low-wing cantilever monoplane of wood and fabric construction. It is powered by a 25 h.p. modified Volkswagen flat-four air-cooled engine which drives a two-blade airscrew.

DIMENSIONS.—
Span 6.55 m. (21 ft. 6 in.).
Length 4.80 m. (15 ft. 9 in.).
Wing area 7.50 m.² (80.7 sq. ft.).

WEIGHTS.—
Weight loaded 230 kg. (506 lb.).

PERFORMANCE.—
Max. speed 145 km.h. (90 m.p.h.).
Cruising speed 115 km.h. (71.4 m.p.h.).
Landing speed 50 km.h. (31 m.p.h.).
Initial rate of climb 150 m./min. (492 ft./min.).



The Druine Turbulent and Turbi Light Monoplanes.

THE DRUINE TURBI.

The Turbi is a two-seat development of the Turbulent. It is fitted with a 50 h.p. Beaussier engine which is built up of components of the 11 h.p. Citroën automobile engine.

DIMENSIONS.—
Span 8.70 m. (28 ft. 6 in.).
Length 6.20 m. (20 ft. 4 in.).
Wing area 13.50 m.² (145.2 sq. ft.).

WEIGHT.
Weight loaded 475 kg. (1,045 lb.).

PERFORMANCE.—
Max. speed 155 km.h. (96 m.p.h.).
Cruising speed 130 km.h. (81 m.p.h.).
Landing speed 55 km.h. (34 m.p.h.).
Initial rate of climb 150 m./min. (492 ft./min.).

FARMAN

SOCIÉTÉ DES USINES FARMAN.

HEAD OFFICE: 55, AVENUE GEORGES V, PARIS (16E).

WORKS: BILLANCOURT (SEINE).

The original Farman company was formed by Henri Farman, one of the pioneers of French aviation, in 1908. Maurice Farman opened a works a little later. In 1912 the two brothers combined to form the company Avions H. et M. Farman.

When, in 1936, the Popular Front Government introduced the Law for the Nationalisation of Military Industries all of Farman's military aircraft design and production activities were incorporated into the Société Nationale de Constructions Aéronautiques du Centre, leaving only a comparatively small proportion of the company's affairs under private control. It is from this remnant of the original company that the present concern is derived.

In 1939 Farman acquired a licence to build the Stampe S.V.4 trainer and large orders for this aircraft were placed with the company by the French Government. Only a few were completed before the fall of France. After the war the S.V.4 manufacturing rights were transferred to the Société Nationale de Constructions Aéronautiques du Nord but Farman retained the licence.

The Société Farman, with the collaboration of M. Stampe, has now produced a two-seat monoplane trainer which incorporates many of the components of the S.V.4, including the fuselage, tail-unit and power-plant. This aircraft, the Monitor I, flew for the first time on July 11, 1952.

Farman is also engaged in the production under sub-contract of components for Marcel Dassault.

THE FARMAN MONITOR I.

TYPE.—Two-seat Trainer.

WINGS.—Low-wing cantilever monoplane. Two-spar wood structure with fabric covering. Gross wing area 14 m.² (150.6 sq. ft.).

FUSELAGE.—Welded steel-tube structure covered with fabric.

TAIL UNIT.—Braced monoplane type.

LANDING GEAR.—Fixed tail-wheel type. Cantilever main shock-absorber legs. Wheel brakes. S.V.4 type tail-wheel.

POWER PLANT.—One 140 h.p. Snecma Renault 4 Pei four-cylinder in-line inverted air-cooled engine.

ACCOMMODATION.—Tandem cockpits beneath continuous canopy with sliding sections over seats. Dual controls.

DIMENSIONS.—
Span 9.44 m. (30 ft. 11 in.).
Length 6.77 m. (22 ft. 2½ in.).
Height 2.42 m. (7 ft.11 in.).

WEIGHTS.—
Weight empty 560 kg. (1,232 lb.).
Weight loaded 820 kg. (1,804 lb.).

PERFORMANCE.—
Max. speed at S/L. 204 km.h. (127 m.p.h.).
Min. speed without flaps 84 km.h. (52 m.p.h.).
Min. speed with flaps 72 km.h. (44.7 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 4 min. 30 sec.
Absolute ceiling 5,500 m. (18,040 ft.).
Endurance 3 hours.



The Farman Monitor I Trainer (140 h.p. Snecma-Renault engine).

THE FARMAN MONITOR II.

The Monitor II, which won the 1953 competition for trainers meeting the requirements of the S.A.L.S. and D.T.I., is a development of the Monitor I. The wings are now of metal construction with metal covering forward of the spar and the power-plant is a 240 h.p. Salmson AS.8 eight-cylinder inverted Vee air-cooled engine.

DIMENSIONS.—
Span 9.94 m. (30 ft. 11 in.).
Length 7.28 m. (22 ft. 10 in.).
Height 2.20 m. (7 ft. 2½ in.).

WEIGHTS.—
Weight loaded 802 kg. (1,765 lb.).

PERFORMANCE.—
Max. speed 270 km.h. (168 m.p.h.).
Cruising speed 240 km.h. (149 m.p.h.).
Min. speed 75 km.h. (46.5 m.p.h.).
Duration 3 hours.

FOUGA

ÉTABLISSEMENTS FOUGA ET CIE.

HEAD OFFICE AND WORKS: BÉZIERS (HÉRAULT).

AIRCRAFT DEPARTMENT, WORKS AND AERODROME: AIRE-SUR-ADOUR (LANDES).

Director General: Henri Frousteу.

Director of Aircraft Department: Pierre Mauboussin.

Technical Director: Robert Castello.

Director of Production: Paul Quoix.

The Établissements Fouga has operated an Aircraft Department since 1936.

The works at Aire-sur-Adour, covering an area of 14,000 m.² (150,640 sq. ft.), is situated alongside an aerodrome which the company has built with the assistance of the local municipality and the State.

The activities of the Aircraft Department of Fouga et Cie include both the design and construction of aircraft and gliders of original design and the repair and overhaul of aircraft for the French Air Force.

The latest products of the company include the C.M. 8-R.13 Sylphe jet-powered glider; the C.M. 8-R.9.8 Cyclope jet trainer; the C.M. 8-R.8.3 Midjet jet racer; the C.M. 88R Gemeaux twin-fuselage experimental monoplane; the C.M. 170R twin-jet fighter trainer; and the C.M. 71 two-seat high-performance sailplane. Other current types, previously described in "All the World's Aircraft," are the C.M. 311P single-seat sailplane; the C.801 two-seat training glider and the C.M. 8-13 and 8-15 sailplanes.

THE FOUGA C.M.170R MAGISTER.

The C.M.170R is a light two-seat jet fighter trainer which has been ordered by the French Air Ministry. The first prototype flew for the first time on July 23, 1952.

TYPE.—Two-seat Fighter Trainer.

WINGS.—Mid-wing cantilever monoplane. 7.4. Root chord 1.98 m. (6 ft. 6 in.), tip chord 0.87 m. (2 ft. 10 in.). Single-spar all-metal structure. All-metal ailerons and slotted flaps. Total aileron area 1.02 m.² (10.97 sq. ft.), total flap area 2.13 m.² (22.92 sq. ft.). Retractable air brakes in upper and lower surfaces. Gross wing area 17.30 m.² (186.1 sq. ft.).

FUSELAGE.—Oval all-metal stressed-skin structure.

TAIL UNIT.—"Butterfly" type. All-metal structure. Area of fixed surfaces 2.35 m.² (25.3 sq. ft.) of movable surfaces 1.50 m.² (16.1 sq. ft.).

LANDING GEAR.—Retractable nose-wheel type. Steerable nose-wheel with anti-shimmy device. Hydraulic brakes on main wheels.

POWER PLANT.—Two Turboméca Marboré II turbojet engines (400 kg.=880 lb. s.t.) mounted on sides of fuselage. Two fuel tanks in fuselage. Total capacity 700 litres (154 Imp. gallons). Two wing-tip tanks (125 litres=27.5 Imp. gallons each) may be fitted.

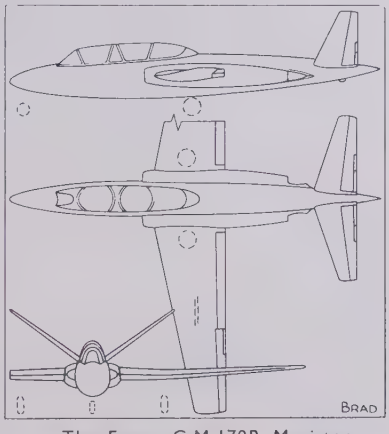
ACCOMMODATION.—Tandem cockpits under continuous transparent canopy. Seats adjustable for height. Radio compass, VHF radio, and blind flying equipment.

ARMAMENT.—Two machine-guns and gyro sights, ciné-gun, two rocket launchers, and two racks for 50 kg. (110 lb.) bombs.

DIMENSIONS.—
Span (without tip tanks) 11.3 m. (37 ft. 0 in.).
Length 9.8 m. (32 ft. 2 in.).
Height 2.8 m. (9 ft. 2½ in.).



The third prototype Fouga C.M.170R Magister which has a normal cruciform tail-unit.



The Fouga C.M.170R Magister.

WEIGHTS.—
Weight empty 2,100 kg. (4,620 lb.).
Crew (2) 170 kg. (374 lb.).
Internal fuel and oil 600 kg. (1,320 lb.).
Weight loaded 2,870 kg. (6,314 lb.).

PERFORMANCE (at 2,870 kg. = 6,314 lb. A.U.W.).—
Max. speed 700 km.h. (435 m.p.h.) at 6,000 m. (19,680 ft.).
Max. rate of climb 1,020 m./min. (3,350 ft./min.).
Climb to 6,000 m. (19,680 ft.) 9 min. 30 sec.
Max. range (with auxiliary fuel) 1,200 km. (745 miles).
Take-off distance to 15 m. (50 ft.) 580 m. (634 yds.).

THE FOUGA C.M.8.R-8.3 MIDJET.

The Midjet is a single-seat competition aircraft which is derived from the Cyclope III, from which it differs principally in having wings of reduced span and area.

Twelve Midjets have been built to participate in organized air racing.

The structural details are the same as for the Sylphe and Cyclope described later.

LANDING GEAR.—Single-track type. Steerable nose-wheel and single main wheel with disc brakes. Both wheels have hydraulic springing. Retractable wing-tip skids.

POWER PLANT.—One Turboméca Palas turbojet (150 kg.=330 lb. T.O. and 120 kg.=264 lb. maximum continuous thrust). Two 64 litre (13 Imp. gallon fuel tanks) in wing leading-edges, one on each side of fuselage.

ACCOMMODATION.—Enclosed cockpit. Adjustable seat. Provision for back-type parachute.

DIMENSIONS.—
Span 7.07 m. (23 ft. 2 in.).
Length 6.70 m. (21 ft. 11 in.).



The Fouga C.M.170R Magister Fighter Trainer (two Turboméca Marboré II turbojet engines).

Height 1.85 m. (6 ft.).
Wing area 8.3 m.² (89.3 sq. ft.).

WEIGHTS.
Weight empty 363 kg. (800 lb.).
Pilot 80 kg. (175 lb.).
Fuel and oil 100 kg. (220 lb.).
Weight loaded 543 kg. (1,195 lb.).

PERFORMANCE.
Max. speed at T.O. power 350 km.h. (217 m.p.h.).
Speed at max. cont. power 325 km.h. (204 m.p.h.).
Rate of climb 540 m./min. (1,770 ft./min.).
Take-off distance to 15 m. (50 ft.) 450 m. (492 yds.).
Range at S/L. 175 km. (108 miles).

THE FOUGA C.M. 8.R-9.8 CYCLOPE III.

The Cyclope is a single-seat training and aerobatic version of the Sylphe, from which it differs by having wings of reduced span and area and a single-track landing-gear with nose wheel, twin main wheels and retractable wing-tip skids.

In its latest Mk. III form, powered with the Turboméca Palas turbojet (150 kg.= 330 lb. s.t.), it has been chosen to equip the French Air Force aerobatic team "Patrouille d'Etampes."

DIMENSIONS.
Span 8.76 m. (28 ft. 9 in.).
Length 6.66 m. (21 ft. 10 in.).
Height 1.78 m. (5 ft. 10 in.).
Wing area 9.8 m². (105.4 sq. ft.).

WEIGHTS.—
Weight empty 410 kg. (902 lb.).
Pilot 83 kg. (183 lb.).
Fuel and oil 77 kg. (170 lb.).
Weight loaded 570 kg. (1,255 lb.).

PERFORMANCE.—
Max. speed at S/L. 330 km.h. (205 m.p.h.).
Max. speed at 4,000 m. (13,120 ft.) 350 km.h. (217 m.p.h.).
Initial rate of climb 480 m./min. (1,575 ft./min.).
Service ceiling 9,500 m. (31,160 ft.).
Take-off distance to 20 m. (66 ft.) 280 m. (306 yds.).
Range at 4,000 m. (13,120 ft.) 300 km. (186 miles).

THE FOUGA C.M. 8.R-13 SYLPHE III.

The Sylphe III is the latest development in the series of powered gliders evolved from the C.M. 8 sailplane. It flew for the first time in January, 1952.

TYPE.—Single-seat sailplane with auxiliary jet power.

WINGS.—Mid-wing cantilever monoplane. NACA 230 wing section. Aspect ratio 13. Dihedral 3° 10′ on upper surface. Single-spar all-wood stressed-skin structure. Metal framed, fabric-covered slotted flaps and slotted ailerons. Retractable air-brakes in upper and lower wing surfaces. Gross wing area 13 m.² (140 sq. ft.).

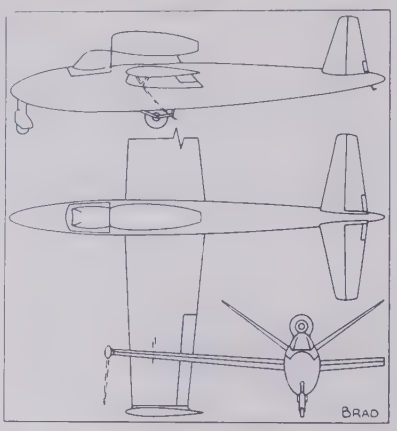
FUSELAGE.—Oval wood monocoque structure.

TAIL UNIT.—"Butterfly" type. Fixed surfaces all-wood, movable surfaces all-metal. Area of fixed surfaces 1.35 m.² (14.52 sq. ft.), of movable surfaces 1.09 m.² (11.73 sq. ft.).

LANDING GEAR.—Fixed single-track type. Small steerable nose-wheel and main-wheel with disc brake, both hydraulically sprung.



The Fouga C.M.8.R-8.3 Midjet (Turboméca Palas turbojet engine).



The Fouga C.M.8.R-8.3 Midjet.

POWER PLANT.—One Turboméca Piméné turbojet engine (100 kg.—220 lb. s.t.), mounted on top of fuselage behind cockpit. Two fuel tanks (40 litres = 8.8 Imp. gallons each) in wing leading-edges. One auxiliary tank (50 litres = 11 Imp. gallons) in fuselage.

ACCOMMODATION.—Enclosed cockpit ahead of wing. Oxygen equipment.

DIMENSIONS.—
Span 13.0 m. (42 ft. 7½ in.).
Length 6.70 m. (21 ft. 11 in.).
Height 1.85 m. (6 ft. 1 in.).

WEIGHTS.—
Weight empty 435 kg. (958 lb.).
Pilot 88 kg. (194 lb.).
Fuel and oil 110 kg. (242 lb.).
Weight loaded 633 kg. (1,394 lb.).

PERFORMANCE.—
Max. speed 250 km.h. (155 m.p.h.) at 4,000 m. (13,120 ft.).
Economic cruising speed 180 km.h. (112 m.p.h.) at 4,000 m. (13,120 ft.).
Initial rate of climb 210 m./min. (690 ft./min.).
Service ceiling 11,000 m. (36,080 ft.).
Take-off run 250 m. (273 yds.).
Range (with power off on glide) 520 m. (323 miles).

THE FOUGA C.M. 88-R GEMEAUX.

The C.M. 88-R Gemeaux consists of two fuselages and two outer wings of the Cyclope, the fuselages being joined together by a centre wing and a connecting member aft. Each fuselage has its single cockpit and "butterfly" tail, the inner panels of the latter being shortened so that they do not touch.

Two basic Gemeaux airframes are serving as test-beds for various types of Turboméca turbojets, and have flown in the following forms :—

Gemeaux I. Powered by two Turboméca Piméné engines (100 kg.=220 lb. s.t. each) one on each fuselage as in the Cyclope. First flew on March 6, 1951.



The Fouga C.M. 8.R-13 Sylphe III (Turboméca Piméné turbojet engine).

Gemeaux II. Powered by one Turboméca Marboré I (275 kg.=605 lb. s.t.) mounted on centre wing midway between fuselages. First flew on June 16, 1951.

Gemeaux III. Powered by one Turboméca Marboré II (400 kg.=880 lb. s.t.) mounted as in Mk. II. First flew with prototype Marboré II (350 kg.=770 lb. s.t.) on August 24, 1951, and with production Marboré II (400 kg.=880 lb. s.t.) on January 2, 1952.

Gemeaux IV. Powered by one Turboméca Aspin I ducted-fan turbojet (200 kg.=440 lb. s.t.). First flew on November 6, 1951.

Gemeaux V. Powered by one Turboméca Aspin II ducted fan turbojet (360 kg.=790 lb. s.t.). First flew on June 21, 1952.

The following general particulars apply.

TYPE.—Two-seat twin-fuselage experimental monoplane.

WINGS.—Mid-wing cantilever monoplane. NACA 230 wing section. Aspect ratio 13. Dihedral (outer wings) 3° 10′ on upper surface. Single-spar all-wood stressed-skin structure. Slotted flaps and slotted ailerons have light alloy frames and fabric covering. Retractable air brakes in upper and lower surfaces of outer wings. Gross wing area 12.80 m.² (137.7 sq. ft.).

FUSELAGES.—All-wood monocoque structures.

TAIL UNIT.—Double "butterfly" type. Fixed surfaces of wood with plywood covering, moveable surfaces have light alloy frames and skin. Total area of fixed surfaces 2.71 m.² (29.1 sq. ft.), total area of moveable surfaces 1.74 m.² (18.7 sq. ft.).

LANDING GEAR.—Quadricycle type. One steerable nose-wheel and one main wheel with hydraulic brake in each fuselage. Hydraulic shock-absorbers.

POWER PLANT.—See above. Five fuel tanks, three in wing leading-edges and two on fuselage. Total turbofuel capacity 220 litres (48.4 Imp. gallons).



Above, the Fouga Gemeaux I (Turboméca Piméné) and, below, the Gemeaux IV (Turboméca Aspin)

ACCOMMODATION.—Enclosed cockpit in each fuselage. Adjustable seat for back-type parachute. Oxygen equipment and VHF radio.

DIMENSIONS.—
Span 10.76 m. (35 ft. 4 in.).
Length 6.66 m. (21 ft. 10 in.).
Height 1.93 m. (6 ft. 4 in.).

WEIGHTS (Gemeaux I).—
Weight empty 750 kg. (1,650 lb.).
Fuel and oil 180 kg. (396 lb.).
Crew (2) 166 kg. (365 lb.).
Weight loaded 1,096 kg. (2,411 lb.).

WEIGHTS (Gemeaux II).—
Weight empty 820 kg. (1,804 lb.).
Weight loaded 1,166 kg. (2,565 lb.).

WEIGHTS (Gemeaux III).—
Weight empty 890 kg. (1,958 lb.).
Weight loaded 1,236 kg. (2,719 lb.).

WEIGHTS (Gemeaux IV).—
Weight empty 820 kg. (1,804 lb.).
Weight loaded 1,171 kg. (2,576 lb.).

WEIGHTS (Gemeaux V).—
Weight empty 885 kg. (1,947 lb.).
Weight loaded 1,236 kg. (2,719 lb.).

PERFORMANCE (Gemeaux I).—
Max. speed at S/L. 285 km.h. (177 m.p.h.).
Economic cruising speed 220 km.h. (136.6 m.p.h.) at 2,000 m. (6,560 ft.).
Rate of climb 210 m./min. (690 ft./min.).
Service ceiling 7,000 m. (22,960 ft.).
Take-off run 370 m. (405 yds.).
Duration 1½ hours.

PERFORMANCE (Gemeaux II).—
Max. speed at S/L. 330 km.h. (205 m.p.h.).
Economic cruising speed 260 km.h. (161.4 m.p.h.) at 3,000 m. (9,840 ft.).
Rate of climb 360 m./min. (1,180 ft./min.).
Service ceiling 8,500 m. (27,880 ft.).
Take-off run 300 m. (328 yds.).
Duration 1 hour 15 minutes.

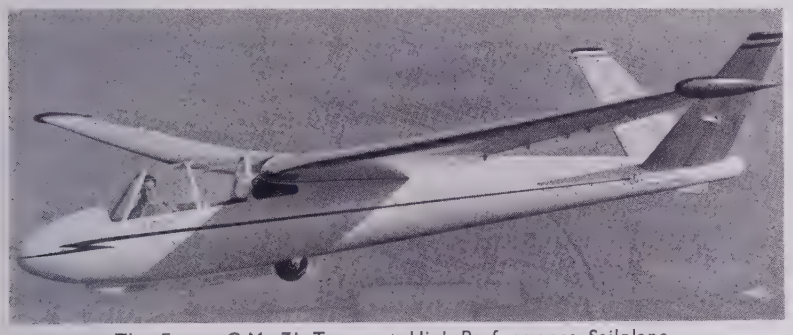
PERFORMANCE (Gemeaux III).—
Max. speed at S/L. 400 km.h. (248 m.p.h.).
Economic cruising speed 300 km.h. (186 m.p.h.).
Rate of climb 600 m./min. (1,968 ft./min.).
Service ceiling 10,000 m. (32,800 ft.).
Take-off run 250 m. (273 yds.).
Duration 1 hour.

PERFORMANCE (Gemeaux IV).—
Max. speed at S/L. 250 km.h. (155 m.p.h.).
Economic cruising speed 200 km.h. (124 m.p.h.) at 2,000 m. (6,560 ft.).
Rate of climb 180 m./min. (590 ft./min.).
Service ceiling 3,000 m. (9,840 ft.).
Take-off run 600 m. (656 yds.).
Duration 2 hours.

PERFORMANCE (Gemeaux V).—
Max. speed at S/L. 330 km.h. (205 m.p.h.).
Economic cruising speed 250 km.h. (155 m.p.h.) at 3,000 m. (9,040 ft.).
Rate of climb 450 m./min. (1,476 ft./min.).
Service ceiling 7,000 m. (22,960 ft.).
Take-off run 350 m. (383 yds.).
Duration 2 hours.



The Fouga Gemeaux III (Turboméca Marboré II turbojet engine).



The Fouga C.M. 71 Two-seat High Performance Sailplane.

THE FOUGA C.M. 71.

The C.M. 71 is a high performance sailplane which has been developed from the C.M. 7. It has been ordered by the Service de l'Aviation Légère et Sportive (S.A.L.S.).

TYPE.—Two-seat high performance sailplane.

WINGS.—High-wing cantilever monoplane. Wing section Goettingen 695 at root, tapering to NACA 230 at tip. Aspect ratio 14.6. Dihedral 4°. Single-spar all-wood structure. All-wood slotted ailerons. Retractable spoilers in form of metal plates which may be revolved on their axes to protrude from or be withdrawn within upper and lower wing contours. Gross wing area 22.27 m.² (239.6 sq. ft.).

FUSELAGE.—Oval wood monocoque structure.

TAIL UNIT.—"Butterfly" type. All-wood frames with fixed surfaces plywood-covered and movable surfaces fabric-covered. Areas of fixed surfaces 1.67 m.² (17.9 sq. ft.), of movable surfaces 1.83 m.² (19.7 sq. ft.).

LANDING GEAR.—Wood skid, rubber-sprung, and single-wheel, with brake, the latter half buried in fuselage. Small tail-skid.

ACCOMMODATION.—Tandem seats under transparent canopy.

DIMENSIONS.—
Span 18 m. (59 ft.).
Length 8.26 m. (27 ft.).
Height 2.26 m. (7 ft. 5 in.).

WEIGHTS.—
Weight empty 385 kg. (847 lb.).
Crew (2) 166 kg. (365 lb.).
Weight loaded 551 kg. (1,212 lb.).

PERFORMANCE (as two-seater).
Min. rate of descent 0.85 m./sec. (2.78 ft./sec.) at 75 km.h. (46.5 m.p.h.).
Speed at max. finesse 85 km.h. (52.7 m.p.h.).
Speed at 1 m./sec. (3.28 ft./sec.) sinking speed 90 km.h. (55.9 m.p.h.).
Speed at 2 m./sec. (6.56 ft./sec.) sinking speed 115 km.h. (71.4 m.p.h.).

HUREL-DUBOIS

AVIONS HUREL-DUBOIS.

HEAD OFFICE AND WORKS: ROUTE DE VERRIÈRES, MEUDON-VILLACOUBLAY (SEINE-ET-OISE).

Avions Hurel-Dubois was formed to build a small single-seat research monoplane with which to demonstrate the theories of M. Hurel regarding the advantages of using wings of high aspect ratio. Theoretical studies and wind-tunnel tests have shown that the induced drag of a monoplane braced by suitably designed lift struts is less than that of a cantilever monoplane of the same span and area. The use of struts permits the doubling or even trebling of the aspect ratio without increasing the weight of the wing, thereby allowing an increase in all-up weight and a considerable increase in useful load with the same power.

The H.D. 10 experimental monoplane, which has been described and illustrated in previous editions of "All the World's Aircraft," completed its official trials with success, in the course of which the efficiency of the wing was fully substantiated. The trials showed the H.D. 10 to have a fineness coefficient of 18 for a C/L of 2.3; that it remained controllable at incidences well below that of maximum lift; that its lateral stability was excellent and the rate of roll surprising.

As the result of the trials with the H.D. 10, the French Government placed an order for two twin-engined cargo aircraft of the same general configuration. The H.D. 31 made its first flight on January 27, 1953, and the H.D. 32 was due to fly before the end of 1953.

Under development is the H.D. 45, a larger medium-range transport to be fitted with two Rolls-Royce Avon turbojet engines, which has also been ordered in prototype form by the French Government.

THE HUREL-DUBOIS H.D. 31.

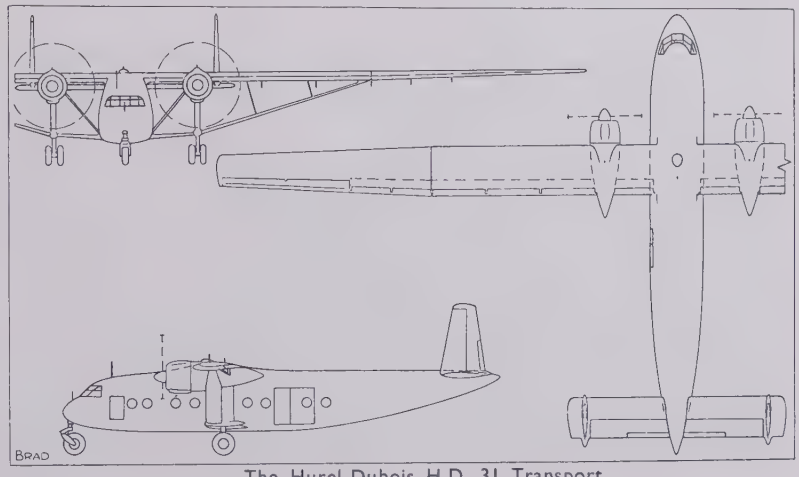
TYPE.—Twin-engined Cargo-carrying monoplane.

WINGS.—High-wing braced monoplane. Aspect ratio 20.2. Wing in three sections, a rectangular centre-section and two tapering detachable outer sections. Centre-section chord 2.4 m. (7 ft. 10½ in.). Outer wings braced with single lift struts attached at their inner ends to small wing stubs which are also braced to the engine nacelles. Double-slotted Fowler-type flaps. Entire wing of all-metal construction. Gross wing area 100 m.² (1,076 sq. ft.).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. All-metal structure. Tailplane incidence adjustable on ground. Statically and aerodynamically balanced control surfaces. Total area of horizontal surfaces 16 m.² (172.1 sq. ft.); of vertical surfaces 13 m.² (139.8 sq. ft.).

LANDING GEAR.—Messier fixed tricycle type. Main shock-absorber struts in fairings



The Hurel-Dubois H.D. 31 Transport.



The Hurel-Dubois H.D. 31 Transport (two 800 h.p. Wright Cyclone C7BA1 engines).

between ends of small stub wings and engine nacelles. Steerable nose-wheel. Main wheel track 7 m. (22 ft. 11½ in.).

POWER PLANT.—Two 800 h.p. Wright C7BA1 or Snecma 14X radial air-cooled engines driving three-blade constant-speed and reversing airscrews.

ACCOMMODATION.—Provision for crew of three, pilot and co-pilot side-by-side with dual controls, and navigator/radio-operator behind the second pilot. Crew compartment heated and soundproofed. The unobstructed main cabin may carry either freight or passengers, or mixed load. Cabin dimensions: length 10 m. (32 ft. 9½ in.), width at floor 2.2 m. (7 ft. 2½ in.), height above floor 2 m. (6 ft. 7 in.), volume above floor 44 m.³ (1,554 cub. ft.), volume usable for freight over 50 m.³ (1,765 cub. ft.), height of cabin floor above ground 1.15 m. (3 ft. 9½ in.). Main cargo loading door 2 m. × 2 m. (6 ft. 6 in. square) on starboard side aft of wing. A small door on same side forward of wing for crew and passengers. Freight holding-down rings in floor and sides of fuselage with necessary harness, etc. Up to 36 passengers may be carried. Fittings for seats in nine rows of four with central aisle.

DIMENSIONS.—
Span 45 m. (147 ft. 7 in.).
Length 22 m. (72 ft. 2 in.).
Height 6.8 m. (22 ft. 4 in.).

WEIGHTS (Designed).—
Weight empty (equipped) 8,950 kg. (19,690 lb.).
Disposable load 4,550 kg. (10,010 lb.).
Weight loaded 13,500 kg. (29,700 lb.).

PERFORMANCE (Estimated).—
Max. speed at S/L. 270 km.h. (167.6 m.p.h.).
Max. speed at 3,000 m. (9,840 ft.) 280 km.h. (173.8 m.p.h.).
Cruising speed at 3,000 m. (9,840 ft.) 247 km.h. (153.5 m.p.h.).
Landing speed 97 km.h. (64 m.p.h.).
Climb to 3,000 m. (9,840 ft.) 16.5 min.
Service ceiling 5,900 m. (19,350 ft.).
Take-off distance to 15 m. (50 ft.) 550 m. (600 yds.).
Range (with 3,250 kg. = 7,150 lb. payload) 1,000 km. (620 miles).
Range (with 2,300 kg. = 5,060 lb. payload) 2,000 km. (1,240 miles).

THE HUREL-DUBOIS H.D. 32.

The H.D. 32 is similar to the H.D. 31, but is powered by two 1,200 h.p. Pratt & Whitney R-1830-92 Twin-Wasp engines. There will be accommodation for 42 passengers.

WEIGHTS.—(Cargo version).—
Weight empty 10,080 kg. (22,176 lb.).
Disposable load 7,270 kg. (15,994 lb.).
Weight loaded 17,350 kg. (38,170 lb.).

WEIGHTS (Passenger version).—
Weight empty 10,380 kg. (22,836 lb.).
Disposable load 6,120 kg. (13,464 lb.).
Weight loaded 16,500 kg. (36,300 lb.).

PERFORMANCE (Estimated).—
Max. speed at S/L. 305 km.h. (185.4 m.p.h.).
Max. speed at 3,000 m. (9,840 ft.) 320 km.h. (198.7 m.p.h.).
Economic cruising speed at 3,000 m. (9,840 ft.) 280 km.h. (173.8 m.p.h.).
Climb to 3,000 m. (9,840 ft.) 12 min.
Service ceiling 6,600 m. (21,650 ft.).
Take-off run to clear 15 m. (50 ft.) 650 m. (710 yds.).
Landing run 300 m. (328 yds.).

RANGES (Cargo version at 17,350 kg. = 38,170 lb. A.U.W.).—
With 5,770 kg. = 12,694 lb. payload 1,000 km. (621 miles).
With 4,860 kg. = 10,692 lb. payload 2,000 km. (1,242 miles).

RANGES (Passenger version at 16,500 kg. = 36,300 lb. A.U.W.).—
With 4,640 kg. = 10,208 lb. payload 1,000 km. (621 miles).
With 3,750 kg. = 8,305 lb. payload 2,000 km. (1,242 miles).
NOTE.—In calculating above ranges no allowances are made for fuel reserves and wind.

THE HUREL-DUBOIS H.D. 45.

The H.D. 45 will be a turbojet-powered transport of similar configuration to that of the previously-described aircraft. It will be powered by two Hispano-Suiza Avon RA.16 engines and will be considerably cleaner aerodynamically than its predecessors.

There will be accommodation for 56-64 first class, or 70-80 second-class, passengers, and holds for 2 tonnes of freight and baggage.

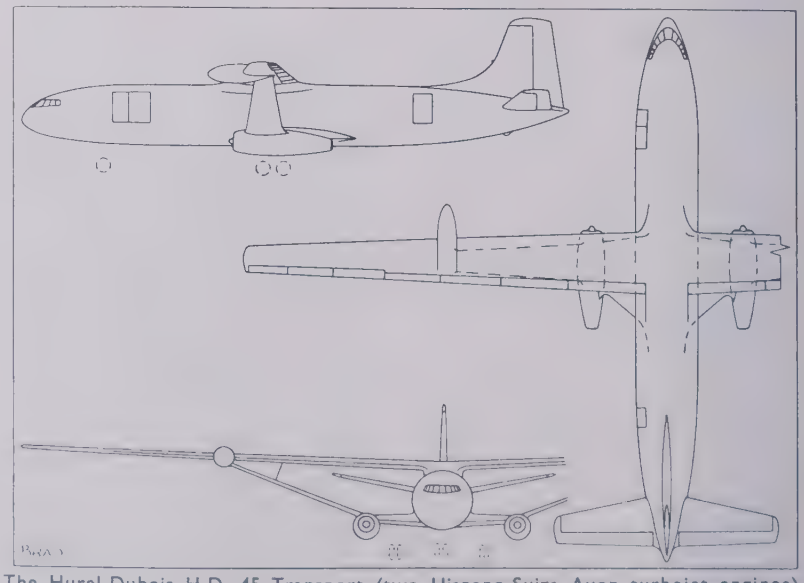
The H.D. 45 is expected to be ready to fly by the end of 1955 or early in 1956.

DIMENSIONS.—
Span 45 m. (147 ft. 7 in.).
Length 29 m. (95 ft. 1½ in.).
Height 8.85 m. (29 ft.).
Gross wing area 108 m.² (1,162 sq. ft.).

WEIGHTS (Designed).—
Weight empty 20,750 kg. (45,650 lb.).
Disposable load 20,250 kg. (44,500 lb.).
Weight loaded 41,000 kg. (90,200 lb.).

PERFORMANCE (Estimated).—
Cruising speed at 10,000 m. (32,800 ft.) 710 km.h. (441 m.p.h.).
Take-off to clear 11 m. (36 ft.) 1,280 m. (1,400 yds.).
Take-off to clear 11 m. (36 ft.) with one engine out at end of run 1,800 m. (1,968 yds.).
Landing distance from 15 m. (50 ft.) 1,500 m. (1,640 yds.).

RANGES (Estimated).—
With 10,700 kg. = 23,540 lb. payload and fuel reserves 2,000 km. (1,240 miles).
With 9,200 kg. = 20,240 lb. payload and fuel reserves 2,500 km. (1,550 miles).
With 7,700 kg. = 16,940 lb payload and fuel reserves 3,000 km. (1,860 miles).
Max. range with full tanks, but no reserves at 6,350 kg. = 13,970 lb. payload (no wind) 4,600 km. (2,860 miles).



The Hurel-Dubois H.D. 45 Transport (two Hispano-Suiza Avon turbojet engines).

INDRAERO

SOCIETÉ INDRAÉRO.

ADDRESS : CLION (INDRES).

Proprietors : MM. Chapeau and Blanchet.

MM. Chapeau and Blanchet have built many aircraft, in particular the Lévrier, which was exhibited at the 1946 Salon de l'Aéronautique.

Their latest product is the Aéro 110, a two-seat light biplane ten of which have been ordered by the S.A.L.S. (Service de l'Aviation Légère et Sportive).

The prototype Aéro 110, illustrated and described herewith, is powered by a 45 h.p. Salmson radial engine, but the production aircraft will be fitted with the 75 h.p. Minié flat-four engine and will have some minor detail changes.



The Aéro 110 (45 h.p. Salmson 9ADB engine).

THE AÉRO 110.

TYPE.—Two-seat Light Trainer.

WINGS.—Single-bay staggered biplane. Upper and lower wings of equal span and chord. Wood monospar structure with fabric covering. I-type interplane struts. Ailerons on lower wings only. Gross wing area 14 m.² (150.6 sq. ft.).

FUSELAGE.—Steel tube frame work covered with fabric.

TAIL UNIT.—Braced monoplane type. Wood framework, fabric covering.

LANDING GEAR.—Fixed type. Faired side vees and half-axles hinged to steel tube pyramid under the fuselage. Rubber-in-compression springing. Fixed tail-skid. Steerable tail-skid will be fitted to production model.

POWER PLANT.—One 45 h.p. Salmson 9ADB nine-cylinder radial air-cooled engine. Merville two-blade wood airscrew. Fuel tank in fuselage. Production aircraft to be fitted with 75 h.p. Minié 4.DC.32 flat-four engine.

ACCOMMODATION.—Tandem open cockpits with dual controls. Hinged panel in upper wing for access to front cockpit.

DIMENSIONS.—
Span 7.60 m. (24 ft. 11 in.).
Length 5.60 m. (18 ft. 4 in.).

WEIGHTS (45 h.p. Salmson engine).—
Weight empty 270 kg. (594 lb.).
Weight loaded 455 kg. (1,000 lb.).

PERFORMANCE (45 h.p. Salmson engine).—
Max. speed 130 km.h. (81 m.p.h.).
Cruising speed 115 km.h. (71.4 m.p.h.).
Initial rate of climb 126 m./min. (413 ft./min.).

PERFORMANCE (75 h.p. Minié engine).—
Max. speed 175 km.h. (108.6 m.p.h.).
Cruising speed 150 km.h. (93 m.p.h.).
Initial rate of climb 192 m./min. (630 ft./min.).

JODEL

SOCIÉTÉ DES AVIONS JODEL.

HEAD OFFICE AND WORKS : ROUTE DE SEURRE, BEAUNE (CÔTE-D'OR).

The Société des Avions Jodel was formed in March, 1946, by MM. Jean Delemontez and Edouard Joly, with the former acting as business and technical manager and the latter as test pilot.

Its first activities were concerned with the repair of gliders and light aircraft of the Service d'Aviation Légère et Sportive on behalf of the State.

In the meantime the company designed and built the D.9 single-seat light monoplane, the Bébé Jodel, which made its first flight in January, 1948. This aeroplane, which has received its airworthiness certificate with various power-plants, is intended for the amateur constructor and over 200 kits have already been sold.

As the result of official tests with the D.9, the French authorities placed an order for the development and construction of two prototypes of a two-seat model, the D.11, fitted with the 45 h.p. Salmson, and the D.111, fitted with the 75 h.p. Minié engine. A further model, the D.112, is fitted with a 65 h.p. Continental engine and is also flying.

The D.11 is now being built in series for the Government and 100 kits have been supplied to amateur constructors.

THE JODEL D.9 BÉBÉ.

TYPE.—Single-seat Light monoplane.

WINGS.—Low-wing cantilever monoplane. Single-spar one-piece wing with wide-span centre-section of constant chord and thickness and two tapering outer portions set at a coarse dihedral angle. Spar and ribs of spruce and plywood with fabric covering. Ailerons on outer portions. Gross wing area 9 m.² (96.8 sq. ft.).

FUSELAGE.—Rectangular spruce and plywood structure.

TAIL UNIT.—Cantilever monoplane type. No fin. Spruce and plywood frames with plywood-covered tailplane and fabric-covered rudder and elevators.

LANDING GEAR.—Divided type. Cantilever legs with rubber-in-compression springing. Leaf spring tail-skid.

POWER PLANT.—Either one 25 h.p. Poinsard or 34 h.p. A.B.C. Scorpion two-cylinder horizontally-opposed or 26 h.p. Volkswagen flat-four air-cooled engine. Fuel tank in fuselage.

ACCOMMODATION.—Single open cockpit.

DIMENSIONS.—
Span 7 m. (22 ft. 11 in.).
Length (Poinsard) 5.35 m. (17 ft. 6 in.).
Length (Scorpion) 5.40 m. (17 ft. 8½ in.).
Length (Volkswagen) 5.45 m. (17 ft. 10½ in.).

WEIGHTS (Poinsard engine).—
Weight empty 143 kg. (315 lb.).
Disposable load 110 kg. (242 lb.).
Weight loaded 253 kg. (557 lb.).

WEIGHTS (Scorpion engine).—
Weight empty 160 kg. (352 lb.).
Disposable load 110 kg. (242 lb.).
Weight loaded 270 kg. (594 lb.).

WEIGHTS (Volkswagen engine).—
Weight empty 162 kg. (356 lb.).
Disposable load 110 kg. (242 lb.).
Weight loaded 272 kg. (598 lb.).

PERFORMANCE (Poinsard engine).—
Max. speed 152 km.h. (94.4 m.p.h.).
Cruising speed 115 km.h. (71.4 m.p.h.).
Landing speed 47 km.h. (29 m.p.h.).
Initial rate of climb 150 m./min. (492 ft. min.).
Take-off run 55 m. (60 yds.).
Landing run 70 m. (76 yds.).
Range 400 km. (250 miles).

PERFORMANCE (Scorpion engine).—
Max. speed 170 km.h. (105.5 m.p.h.).
Cruising speed 150 km.h. (93 m.p.h.).
Landing speed 50 km.h. (31 m.p.h.).
Initial rate of climb 240 m./min. (787 ft./min.).
Take-off run 40 m. (44 yds.).
Landing run 70 m. (76 yds.).
Range 400 km. (250 miles).

PERFORMANCE (Volkswagen engine).—
Max. speed 150 km.h. (93 m.p.h.).
Cruising speed 130 km.h. (81 m.p.h.).
Landing speed 50 km.h. (31 m.p.h.).
Initial rate of climb 126 m./min. (412 ft./min.).
Take-off run 110 m. (120 yds.).
Landing run 60 m. (66 yds.).
Range 460 km. (286 miles).

THE JODEL D.11.

The D.11 is a two-seat dual-control version of the D.9. Except for increased overall dimensions, a wider fuselage and enclosed side-by-side cockpit, the D.11 conforms in layout and structure to the D.9. The D.11, which is fitted with a 45 h.p. Salmson radial engine, is also being marketed in kit form.

DIMENSIONS.—
Span 8.2 m. (26 ft. 10 in.).
Length 6.2 m. (20 ft. 4 in.).
Wing area 12.7 m.² (136.6 sq. ft.)

WEIGHTS.—
Weight empty 270 kg. (594 lb.).
Disposable load 215 kg. (473 lb.).
Weight loaded 485 kg. (1,067 lb.).

PERFORMANCE.—
Max. speed 170 km.h. (105.5 m.p.h.).
Cruising speed 155 km.h. (96 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Initial rate of climb 140 m./min. (460 ft./min.).
Take-off run (no wind) 160 m. (175 yds.).
Take-off to 20 m. (66 ft.) 360 m. (395 yds.).
Landing run 80 m. (85 yds.).
Range 600 km. (375 miles).

THE JODEL D.111.

The D.111 is identical to the D.11 except that it is fitted with a 75 h.p. Minié flat-four engine. A small series of the D.111 is under construction.



The Jodel D.9 Bébé (26 h.p. Volkswagen engine).

DIMENSIONS.
Same as D.11 except:
Length 6.28 m. (20 ft. 7 in.).
WEIGHTS.
Weight empty 280 kg. (616 lb.).
Weight loaded 520 kg. (1,144 lb.).
PERFORMANCE.
Max. speed 200 km.h. (124 m.p.h.).
Max. cruising speed 170 km.h. (105.5 m.p.h.).
Economic cruising speed 155 km.h. (96 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Rate of climb 220 m./min. (720 ft. min.).
Take-off run (no wind) 90 m. (98 yds.).
Take-off to 20 m. (66 ft.) 260 m. (284 yds.).
Landing run 90 m. (98 yds.).
Range 700 km. (435 miles).

THE JODEL D.112.

The D.112 is the D.11 fitted with a 65 h.p. Continental flat-four engine.

DIMENSIONS.
Same as D.111.
WEIGHTS.
Weight empty 270 kg. (594 lb.).
Weight loaded 490 kg. (1,078 lb.).
PERFORMANCE.
Max. speed 180 km.h. (112 m.p.h.).
Max. cruising 170 km.h. (105.5 m.p.h.).
Economic cruising 150 km.h. (93 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Rate of climb 175 m./min. (575 ft./min.).
Take-off run (no wind) 120 m. (131 yds.).
Take-off to 20 m. (66 ft.) 300 m. (328 yds.).
Landing run 80 m. (85 yds.).
Range 600 km. (373 miles).



The Jodel D.11 (above) and Jodel D.111 (below) Two-seat Cabin Monoplanes.

LEDUC

RENÉ LEDUC ET FILS.

HEAD OFFICE AND WORKS: 158, QUAI DE BEZONS, ARGENTEUIL (SEINE-ET-OISE).

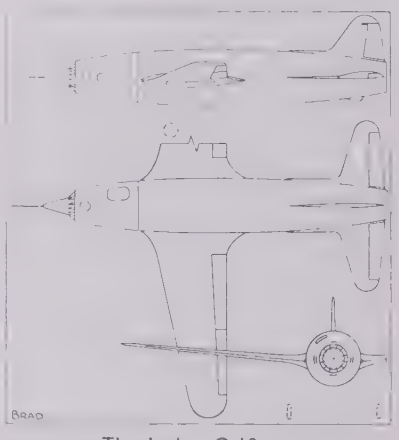
René Leduc has for many years concentrated on the development of the "athodyd" or ram-jet type of power-plant for aircraft. As far back as 1935 he was successful in producing a small unit which developed a thrust of 4 kg. (8.8 lb.) at 300 m./sec. (985 ft./sec.).

His latest production is the 0.10 monoplane the fuselage of which in effect, is a Leduc athodyd which, it is estimated, develops a thrust of 1,600 kg. (3,520 lb.) at 900 km.h. (560 m.p.h.) at sea level. The O.10 was first released as a glider from the top of a Languedoc 161 in October, 1947.

On April 21, 1949, the O.10 with a pilot was released from a Languedoc 161 at 3,050 m. (10,000 ft.) over Toulouse. It flew for 12 minutes and reached a speed of 680 km.h. (450 m.p.h.) on only half power. In a later flight, also on half power, a speed of over 800 km.h. (500 m.p.h.) was attained at a height of 11,000 m. (36,080 ft.), at which height the climbing speed was 2,440 m./min. (8,000 ft./min.).

Three prototypes, all of similar construction and having the same overall dimensions, have been built. The first two are identical, but the third, the O.11, which was air-launched for the first time on February 8, 1951, was originally intended to be fitted with two Turboméca Piméné turbojet engines, one at each wing-tip. These jets, which were at one time fitted but have now been removed, were intended to serve as stand-by power-units for use in the air or for landing. This third prototype also has a mechanically retractable landing-gear.

A fourth and larger prototype, the O.21, which is intended to be able to take-off under its own power, was completed in the Spring of 1953. It made its first flight from a carrier aircraft on May 16, 1953. This version has been built to the order of the French Government.



The Leduc O.10.



The Leduc O.10 on its carrier aircraft, a Languedoc 161.

THE LEDUC O.10.

The Leduc O.10 is an experimental piloted monoplane driven by a Leduc ram-jet or athodyd.

The ram-jet power-plant cannot operate before sufficient air velocity is introduced into the tube. The Leduc O.10 must, therefore, be taken into the air by a carrier aircraft and reach a speed of 320 km.h. (200 m.p.h.) before the fuel can be turned on and ignited. The ultimate use of rocket motors for take-off is envisaged.

TYPE.—Two-seat Experimental RamjetMonoplane.

WINGS.—Cantilever mid-wing monoplane. All-metal structure. Central sealed two-spar box girder serving as integral fuel tank, passes through fuselage. Detachable leading-edge forward and slotted flaps and ailerons aft of box. Gross wing area 16 m.² (172 sq. ft.).

FUSELAGE.—Tubular open-ended fuselage duct is a double-skinned light alloy structure. Suspended in the forward end by cross wires is the pilot's compartment.

TAIL UNIT.—Cantilever monoplane type. Light alloy structure. Fin and halves of tailplane attached to fuselage duct by external fittings.

LANDING GEAR.—Retractable tail-wheel type. Wheels stowed in under-wing filets and when lowered turn through 45 degrees. Manual operation.

POWER PLANT.—Leduc "athodyd" or thermo-propulsive fuselage duct. Air enters annular opening surrounding pilot's cockpit, passes to centre of fuselage where it enters a series of five internal cylindrical ducts of increasing size, the leading-edge of each duct being ringed with fuel injectors, there being a total of 500 burners in all. The resultant mixture is ejected from the rear end of the fuselage as a high-velocity jet. Fuel feed by electrically-driven pump. Fuel (1,135 litres = 250 Imp. gallons) carried in wing.

ACCOMMODATION.—Sealed compartment in front end of fuselage duct seats two in tandem. Perspex nose cone provides forward vision and corresponding circular windows in compartment and outer duct, two on each side, provide lateral vision. Two doors give access to seats. Air-conditioning and heating. Pilot's cockpit and forward portion of fuselage duct can be detached in emergency and lowered by parachute stowed above wing in after portion of compartment, which also encloses small Leduc auxiliary gas-turbine which drives generator.

DIMENSIONS.
Span 10.520 m. (34 ft. 6 in.).
Length 10.250 m. (33 ft. 7 in.).
Wing area 16 m.² (172.1 sq. ft.).
WEIGHT.—
Weight loaded 2,800 kg. (6,160 lb.).

THE LEDUC O.21.

The O.21, which made its first flight from a Languedoc carrier aircraft on May

16, 1953, is about one-third larger than the O.10 previously described, the maximum diameter of the athodyd duct being 2.44 m. (8 ft.).

This version is intended for high-speed research at high altitudes (10,000-20,000 m.), and will be able to take-off by itself when fitted with two Turbomeca Marboré II turbojets mounted one at each wing tip.

The cockpit, which is pressurised and jettisonable, is in the form of a transparent cone completely clear of the front end of the fuselage duct to give 100 per cent. visibility for the crew. Jacottet-Leduc servo controls are fitted.

The athodyd is expected to develop a maximum thrust of 6,000 kg. (13,200 lb.) at 1,000 km.h. (621 m.p.h.).

The landing-gear is of the tandem wheel type, with wing-tip stabilising skids.



The Leduc O.10 Experimental Ramjet Monoplane.

It is estimated that the O.21 will be able to climb to 10,000 m. (32,800 ft.) in 2 minutes and will have a powered duration of 15 minutes at 15,000 m. (49,200 ft.).

DIMENSIONS.—
Span 11.70 (38 ft. 4½ in.).
Length 12.50 m. (41 ft.).

WEIGHT LOADED.—
5,000 kg. (11,000 lb.).



The Leduc O.21 High-speed Research Ramjet Monoplane.

MAX HOLSTE

AVIONS MAX HOLSTE.

HEAD OFFICE: 63, AVENUE DES CHAMPS-ELYSÉES, PARIS (VIIIe).

WORKS: 11, RUE GOSSET, REIMS.

President: René Larousse.

General Director: Max Holste.

Assistant General Director: Charles Dalaudière.

Avions Max Holste has produced several all-metal aircraft, of which the M.H. 52, M.H. 53 and M.H. 152 are the best-known. All have been described in previous issues of this Annual.

The latest product of the company is the M.H. 1521 Broussard, a slightly larger and more powerful version of the M.H. 152. The M.H. 1521 is described hereafter.

THE MAX HOLSTE M.H. 1521 BROUSSARD.

The M.H. 1521 has been designed as a general utility aircraft suitable for use as a light transport carrying a pilot and five passengers; for agricultural spraying and dusting; for ambulance duties; and for military liaison and A.O.P. duties. The prototype M.H. 1521 flew for the first time on November 17, 1952.

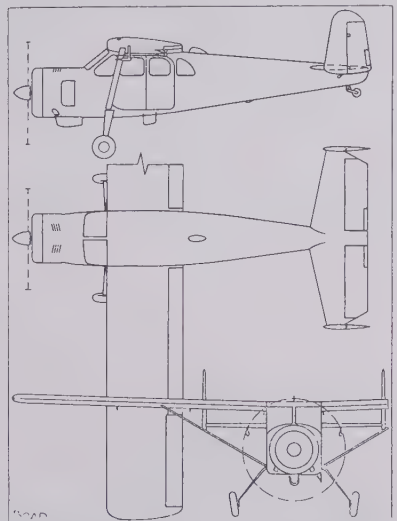
TYPE.—Six-seat General Utility monoplane.

WINGS.—High-wing rigidly-braced monoplane. NACA 44013 wing section. Aspect ratio 7.5. Chord 1.850 m. (6 ft.) constant. Dihedral 1°30'. Incidence 3°. All-dural-umin structure. Central two-spar box with detachable leading-edge. Slotted flaps and ailerons hinged to rear spar. Ailerons arranged to droop 13° when flaps are lowered to 45° while still retaining their differential action. Each single bracing strut is a steel tube with dural sheet fairing. Gross wing area: 25.4 m.² (273.3 sq. ft.).

FUSELAGE.—Duralumin structure with stressed skin canopy.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. Duralumin frames with metal-covered fixed surfaces and fabric-covered elevators and rudders. Controllable trim-tabs in both elevators and in port rudder.

LANDING GEAR.—Fixed tail-wheel type. Spring steel (Cessna licence) main legs. Orientable tail-wheel with self-centering device. ERAM oleo-pneumatic shock-absorber. Brakes on main wheels.



The Max Holste M.H. 1521.

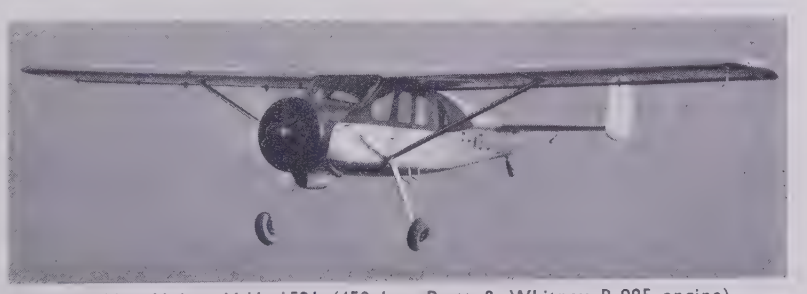
POWER PLANT.—One 450 h.p. Pratt & Whitney R-985 nine-cylinder radial air-cooled engine. Hamilton Standard 2.AD. 30 constant-speed airscrew. Fuel tanks in wing roots.

ACCOMMODATION.—Enclosed cabin seating six in three pairs, the front pair with dual controls. Large door in two parts on port side. As an ambulance can carry pilot, two stretcher cases one-above other on starboard side and two sitting cases on port side. Dimensions of cabin: length 3.08 m. (10 ft. 1 in.), width 1.25 m. (4 ft. 1 in.), average height 1.35 m. (4 ft. 5 in.), volume 4.80 m.³ (169.4 cub. ft.).

DIMENSIONS.—
Span 13.745 m. (45 ft. 1 in.).
Length 8.60 m. (28 ft. 2 in.).
Height 2.80 m. (9 ft. 2 in.).

WEIGHTS AND LOADINGS (Pilot and five passengers).
Weight empty, equipped 1,457 kg. (3,205 lb.).
Pilot 75 kg. (165 lb.).
Fuel and oil 328 kg. (722 lb.).
Useful load 500 kg. (1,100 lb.).
Weight loaded 2,360 kg. (5,192 lb.).
Wing loading 92.8 kg./m.² (19 lb./sq. ft.).
Power loading 5.18 kg./h.p. (11.39 lb./h.p.).

PERFORMANCE.-
Max. speed at S/L. 270 km.h. (168 m.p.h.).
Cruising speed (50% power) at 1,500 m. (4,920 ft.) 230 km.h. (143 m.p.h.).



The Max Holste M.H. 1521 (450 h.p. Pratt & Whitney R-985 engine).

Min. speed 80 km.h. (50 m.p.h.).
Rate of climb at S.L. 360 m./min. (1,180 ft./min.).
Range (with 500 kg. 1,100 lb. commercial load) 1,200 km. (745 miles).
Range (with 600 kg. 1,320 lb. commercial load) 800 km. (500 miles).
Take-off run 155 m. (170 yds.).
Landing run 80 m. (87 yds.).

MATRA-CANTINIEAU

JEAN CANTINIEAU.

ADDRESS: 86, RUE DE CLIGNANCOURT, PARIS.

The Société Matra was responsible for the construction of the Matra-Cantinieau MC-101 helicopter to the designs of M. Jean Cantinieau. The design was begun on February 2, 1952, and less than ten months later, on November 11, 1952, the helicopter made its first flight.

THE MATRA-CANTINIEAU MC-101.

The MC-101 incorporates a number of features of interest. The rotor hub is of the oscillating type and considerable simplification of the rotor drive is achieved by mounting the engine—a 105 h.p. Hirth inverted four-cylinder unit—above the cabin with the rotor driven directly from the engine gear-box (41/6 ratio) and clutch through a Paulstra universal joint. The three main rotor blades are each made of a single duralumin spar cut out of the solid and machined all over. The three-blade anti-torque rotor is driven by cardan shaft through a Paulstra joint.

The main framework is of steel tubing, the side-by-side seats with dual controls being protected by a large Plexiglas screen.



The Matra-Cantinieau MC-101 Helicopter (105 h.p. Hirth engine).

The landing-gear consists of two duralumin skids which are sprung to the main framework.

DIMENSIONS.
Main rotor diameter 8.0 m. (26 ft. 3 in.).
Diameter of anti-torque rotor 1.70 m. (5 ft. 7 in.).
Length of fuselage 6.70 m. (21 ft. 9 in.).
Overall height 2.30 m. (7 ft. 6 in.).
Skid track 1.80 m. (5 ft. 11 in.).

WEIGHTS.
Weight empty 400 kg. (880 lb.).
Crew (2) 160 kg. (352 lb.).
Fuel 40 kg. (88 lb.).
Weight loaded 600 kg. (1,320 lb.).

PERFORMANCE.
Cruising speed 100 km.h. (62 m.p.h.).
Endurance 2 hours.

MAX PLAN

ADDRESS: 115, RUE A. G. BELLIN, ARGENTEUIL (SEINE-ET-OISE).

M. Max Plan, chief of the supersonic tunnel at Meudon Bellevue, has designed and built a small racing aircraft. The S.A.L.S. loaned the 75 h.p. Minié engine which powered the aircraft for its early flights, but M. Plan is now installing an engine of 85 h.p. The Max Plan PF.204 made its first flight on June 5, 1952.

THE MAX PLAN PF.204.

TYPE.—Single-seat Sports monoplane.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 5. Dihedral nil. All-wood structure. Aileron linkage permits their use as flaps. Max. flap deflection 45°. Gross wing area 6.0 m.² (64.5 sq. ft.).

FUSELAGE.—All-wood monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-wood construction.

LANDING GEAR.—Fixed tail-wheel type. Cantilever shock absorber struts with terminal forks for wheels.

POWER PLANT. One 75 h.p. Minié 4 DC 32 four-cylinder horizontally-opposed air-cooled engine. Fuel tank beneath pilot's seat.



The Max Plan PF-204 (75 h.p. Minié 4 DC 32 engine).

ACCOMMODATION. Enclosed cockpit over trailing-edge of wing. Canopy fitted after pilot is in cockpit.

DIMENSIONS.
Span 5.50 m. (18 ft.).
Length 5.3 m. (17 ft. 6 in.).

WEIGHTS AND LOADINGS.
Weight loaded 360 kg. (792 lb.).
Wing loading 60 kg./m.² (12.30 lb./sq. ft.).
Power loading 4.8 kg./h.p. (10.56 lb./h.p.).

PERFORMANCE.—
Max. speed 210 km.h. (130.4 m.p.h.).
Cruising speed 160 km.h. (99.3 m.p.h.).
Landing speed 100 km.h. (62.1 m.p.h.).
Initial rate of climb 120 m./min. (394 ft./min.).
Endurance 2½ hours.

MINIÉ

ETABLISSEMENTS VICTOR MINIE AÉRONAUTIQUE.

HEAD OFFICE: 9, PLACE DES TERNES, PARIS.

President and Director General: Maurice Delanne.

This new company represents the amalgamation of the Société Victor Minié Aéronautique, which builds sailplanes, powered gliders and light aircraft; the Société des Moteurs Victor Minié, which builds light aircraft engines; the Société d'Etudes Victor Minié Aviation, a design and project office.

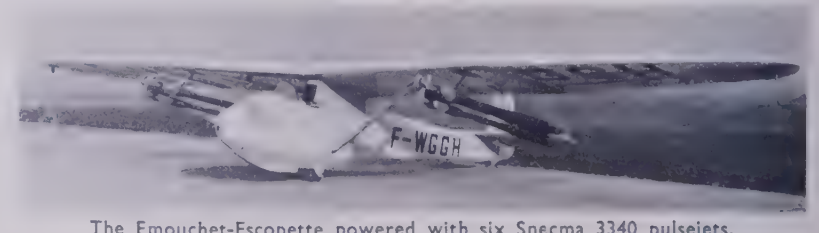
The Société Victor Minié Aeronautique took over from the Arsenal de l'Aéronautique the right to manufacture the gliders and sailplanes designed and previously built by that organization. It has produced the Emouchet (Kestrel) single-seat elementary training glider in series for the Service d'Aviation Légère et Sportive for use in the national gliding centres throughout France.

At the request of the Service Technique de l'Aéronautique, the Société d'Etudes Victor Minié Aviation modified a standard production Emouchet glider to serve as a flying test-bed for the Snecma type 3340 Escopette light pulsejet power-unit. Four of these small pulsejets, each of which develops a thrust of 10 kg. (22 lb.) and weighs 4.5 kg. (10 lb.) were fitted in pairs under the wings outboard of the wing struts. So powered the Emouchet-Escopette flew for the first time on November 30, 1950.

Tests have shown that in spite of the increase in weight due to the pulsejets and test equipment carried the minimum speed of descent with power off was practically the same as for the standard Emouchet glider. The increase in drag was also infinitesimal.

A second Emouchet-Escopette prototype fitted with six pulsejets, three under each wing, flew for the first time at the beginning of June, 1951. This interesting powered glider is seen in the accompanying illustration.

More recently Minié has built a powered glider to the designs of Ingenieur Jarlaud. This aircraft was first towed to height and released as a glider on April 23, 1953. It will later be fitted with its power-plant, a 45 h.p. Lutetia 4.L.02 four-cylinder two-stroke engine. No details of this aircraft were available at the time of writing.



The Emouchet-Escopette powered with six Snecma 3340 pulsejets.



The Morane-Saulnier M.S. 755 Fleuret Jet Trainer (two Turboméca Marboré II turbojet engines).

AEROPLANES MORANE-SAULNIER.

Head Office: 3, Rue Volta, Puteaux (Seine).

Works: Puteaux (Seine), Suresnes (Seine), Alençon (Orne) and Ossun-Louey, near Tarbes (Hautes-Pyrenees).

Commercial Director: M. Sollier.

The Morane-Saulnier Company was originally formed in 1911 and its parasol monoplane fighters were flown by the French Air Force and the Royal Flying Corps in the war of 1914-18. In the inter-war period Morane-Saulnier built many notable aircraft, mainly military trainers and single-seat fighters.

Since the war Morane-Saulnier has concentrated mainly on the design and production of trainers. Its latest types are the M.S. 733 three-seat basic trainer which is in series production for the French Air Force, and the M.S. 755 two-seat jet fighter trainer. Both these types are described hereafter.

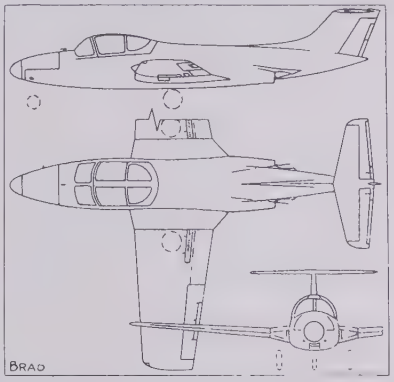
THE MORANE SAULNIER M.S. 755 FLEURET.

Type.—Two-seat Jet Fighter-Trainer.

Wings.—Low mid-wing cantilever monoplane. Wing section NACA 64 A 1 (13.5) at root, (12) at tip. Aspect ratio 5.12. Chord 2.168 m. (7 ft. 1 in.) at root, 1.540 m. (5 ft. 1 in.) at tip. Dihedral 8°. Incidence 2°. All-metal structure. All-metal ailerons with static balance and spring tabs. Electrical-operated all-metal split flaps and air brakes, with emergency mechanical operation. Total area of flaps 1.54 m.² (16.57 sq. ft.). Total area of ailerons 2.30 m.² (24.75 sq. ft.). Gross wing area 18 m.² (193.68 sq. ft.).

Fuselage.—All-metal structure in four sections—nose section, pressurised cabin section, central engine section, and easily detachable tail-section.

Tail Unit.—Cantilever T-type tail. All-metal structure. Areas: fin 1.10 m.² (11.83 sq. ft.), rudder 0.53 m.² (5.70 sq. ft.), tailplane 1.57 m.² (16.89 sq. ft.), elevators (total) 1.28 m.² (13.77 sq. ft.). Tailplane span 3.40 m. (11 ft. 2 in.).



The Morane-Saulnier M.S. 755 Fleuret.



The Morane-Saulnier M.S. 755 Fleuret Jet Trainer.

Landing Gear.—Retractable nose-wheel type. Electrical retraction, with emergency mechanical operation. ERAM oleo-pneumatic shock-absorbers. ERAM wheels and hydraulic brakes. Main wheel track 3.725 m. (12 ft. 2½ in.). Wheelbase 1.78 m. (5 ft. 10 in.).

Power Plant.—Two Turboméca Marboré II turbojet engines (400 kg.=880 lb. s.t. each) mounted in the sides of the fuselage with air inlets in the wing roots. Rear fuselage quickly detachable to give access to engines. Main fuel tank (680 litres=150 Imp. gallons) between engines. Provision for two auxiliary wing-tip tanks (225 litres=49.5 Imp. gallons each). Oil capacity 20 litres (4.4 Imp. gallons).

Accommodation.—Pressurised and air-conditioned cabin seating two side-by-side. Sliding and jettisonable canopy. Emergency escape exit through trap in underside of fuselage. Blind-flying and night-flying equipment, VHF radio, radio and magnetic compasses, etc.

Armament.—Two 7.5 mm. machine-guns in nose of fuselage, ciné gun, racks for two 50 kg. (110 lb.) bombs or four 3.5 in. rockets beneath wings. Gyro gun-sight.

Dimensions.—
- Span 9.56 m. (31 ft. 4 in.).
- Span (over tip tanks) 10.08 m. (33 ft. 0 in.).
- Length 9.70 m. (31 ft. 10 in.).
- Height 2.73 m. (8 ft. 11 in.).

Weights and Loading.—
- Weight empty 1,905 kg. (4,190 lb.).
- Normal loaded weight 2,650 kg. (5,830 lb.).
- Max. permissible loaded weight 3,050 kg. (6,710 lb.).
- Normal Wing loading 147.22 kg./m.² (30.18 lb./sq. ft.).

Performance.—
- Max. speed 720 km.h. (447 m.p.h.) at 6,000 m. (19,680 ft.).
- Initial rate of climb 1,020 m./min. (3,346 ft./min.).
- Service ceiling 12,000 m. (39,360 ft.).
- Take-off run 400 m. (438 yds.).
- Take-off distance to clear 15 m. (50 ft.) 735 m. (805 yds.).



Two views of the Morane-Saulnier M.S. 733 Alcyon Basic Trainer.

THE MORANE-SAULNIER M.S. 733 ALCYON.

The M.S. 733 is the production version of the M.S. 730 series, of which the following prototypes have been built.

M.S. 730. One 180 h.p. Mathis 8G.20 eight-cylinder inverted Vee air-cooled engine. Fixed landing-gear.

M.S. 731. One 240 h.p. Argus As.10 engine. Otherwise same as M.S. 730.

M.S. 732. One 250 h.p. Salmson 8.AS 02 eight-cylinder inverted Vee air-cooled engine. Retractable landing-gear with main wheels raised vertically into fairings at extremities of centre-section. Prototype first flew on February 13, 1951.

M.S. 733. One 230 h.p. Potez 6.D 00A six-cylinder in-line inverted air-cooled engine. Outwardly retracting landing-gear. Otherwise as M.S. 732. First flew on September 25, 1951. In production.

M.S. 735. One 305 h.p. Potez 6.D 30 supercharged six-cylinder in-line inverted air-cooled engine. Otherwise as M.S. 733.

The description and specification which follow refer to the M.S. 733.

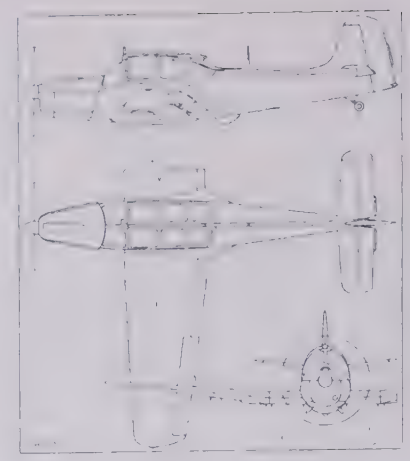
TYPE.—Three-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. Wing section M.S. 1033 modified. Aspect ratio 5.8. Dihedral 12° on outer wings. All-duralumin structure. Slotted flaps. Ailerons on inset hinges. Total aileron area 2.03 m.² (21.8 sq. ft.). Total flap area 2.14 m.² (23 sq. ft.). Gross wing area 21.9 m.² (235.6 sq. ft.).

FUSELAGE.—All-duralumin structure. Two sides and bottom are electrically-welded jig-built units and are riveted together.

TAIL UNIT.—Cantilever monoplane type. All-duralumin structure assembled by riveting and spot welding. Areas: fin 0.756 m.² (8.13 sq. ft.), rudder 1.163 m.² (12.51 sq. ft.), elevators (total) 1.650 m.² (17.75 sq. ft.), tailplane 1.806 m.² (19.43 sq. ft.). Span of tail 3.68 m. (12 ft.).

LANDING GEAR.—Retractable main wheels, non-retractable tail-wheel. ERAM oleo-pneumatic shock-absorbers. Electric retraction, with emergency manual operation. ERAM hydraulic brakes on main wheels. Twin-contact tyre on tail-wheel. Track 2.306 m. (7 ft. 7 in.).



The Morane-Saulnier M.S. 733 Alcyon.

POWER PLANT.—One 230 h.p. Potez 6.D 00A six-cylinder in-line inverted air-cooled engine. Ratier type 2316 hydraulic variable-pitch airscrew 2.25 m. (7 ft. 4⅛ in.) in diameter. Fuel tank in fuselage. Total fuel capacity 245 litres (54 Imp. gallons) Oil capacity 16 litres (3.5 Imp. gallons).

ACCOMMODATION.—Enclosed cockpit seating three, two side-by-side with dual controls in front and one behind. Canopy in two independent halves, right and left, separated by a structural member to protect crew in a turn-over. The halves slide aft for access to cabin and are jettisonable in an emergency. 25G adjustable seats. Blind and night flying amber-screen equipment, VHF radio, radio compass, intercom., heating and ventilation.

DIMENSIONS.—
Span 11.29 m. (37 ft.).
Length (tail-up) 9.34 m. (30 ft. 7 in.).
Height (tail-up) 3.46 m. (11 ft. 4 in.).

WEIGHTS.—
Weight empty 1,262 kg. (2,780 lb.).
Disposable load 408 kg. (900 lb.).
Weight loaded 1,670 kg. (3,680 lb.).

PERFORMANCE.—
Max. speed at S/L. 260 km.h. (162 m.p.h.).
Cruising speed 230 km.h. (143 m.p.h.).
Rate of climb at S/L. 252 m./min. (825 ft./min.).
Time to 2,000 m. (6,560 ft.) 10 min.
Service ceiling 4,800 m. (15,750 ft.).
Cruising endurance at 1,000 m. (3,280 ft.) 4 hrs.
Take-off run 350 m. (383 yds.).

The following figures relate to the M.S. 735 which is fitted with a 305 h.p. Potez 6.D 30 supercharged engine.

WEIGHTS.—
Weight empty 1,292 kg. (2,850 lb.).
Disposable load 408 kg. (900 lb.).
Weight loaded 1,700 kg. (3,750 lb.).

PERFORMANCE.—
Max. speed at S/L. 270 km.h. (168 m.p.h.).
Max. speed at 1,800 m. (5,900 ft.) 285 km.h. (177 m.p.h.).
Cruising speed at 1,800 m. (5,900 ft.) 250 km.h. (155 m.p.h.).
Rate of climb at S/L. 300 m./min. (985 ft./min.).
Service ceiling 6,500 m. (21,000 ft.).
Cruising endurance 3 hrs. 40 min.
Take-off run 290 m. (317 yds.).

MORIN

PIERRE MORIN.

ADDRESS: C/o. AERO-CLUB DU CANTON DE SCEAUX, TOUSSUS-LE-NOBLE (SEINE-ET-OISE).

M. Pierre Morin, an employee of Air France, has designed and built, with the co-operation of the Aéro-Club du Canton de Sceaux, the aircraft described below. It first flew on July 4, 1951, and is now owned by the Club.

THE PIERRE MORIN 01.

TYPE.—Single-seat Light monoplane.

WINGS.—High-wing braced monoplane. NACA 23012 wing section. Chord 1.25 m. (4 ft. 1 in.). Two-spar wood structure with fabric covering. Vee bracing struts. Gross wing area 8.15 m.² (87.7 sq. ft.).

FUSELAGE.—Wood framework with fabric covering.

TAIL UNIT.—Cantilever monoplane type. Wood framework, fabric covering.

LANDING GEAR.—Fixed tail-wheel type.

POWER PLANT.—One 25 h.p. Volkswagen four-cylinder horizontally-opposed air-cooled engine. Merville two-blade wood airscrew. Two fuel tanks in wings. Total fuel capacity 45 litres (10 Imp. gallons).

ACCOMMODATION.—Single open cockpit.



The Pierre Morin 01 (25 h.p. Volkswagen engine).

DIMENSIONS.—
Span 7.10 m. (23 ft. 3½ in.).
Length 5.0 m. (16 ft. 5 in.).

WEIGHTS AND LOADINGS.—
Weight empty 125 kg. (275 lb.).
Weight loaded 225 kg. (495 lb.).
Wing loading 27 kg./m.² (5.53 lb./sq. ft.).

PERFORMANCE.—
Max. speed 125 km.h. (77.6 m.p.h.).
Cruising speed 110 km.h. (68.3 m.p.h.).
Initial rate of climb 80 m./min. (262 ft./min.).

NORD

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU NORD (S.N.C.A.N.).

HEAD OFFICE: 20, RUE VERNIER, PARIS (17e).

WORKS: LE HAVRE (SEINE INF.), BOURGES (CHER), LES MUREAUX (SEINE-ET-OISE), MEAULTE (SOMME), SARTROUVILLE (SEINE-ET-OISE) AND VILLEURBANNE (RHÔNE).

Director-General: M. J. Piette.
Technical Director: M. Louis Corollor.
Chief Engineers: MM. Alain Buiot, Calvy and Montlaur.
Director of Production: M. Vellutini.
Commercial Director: M. Leconte.

The Société Nationale de Constructions Aéronautiques du Nord was formed in 1937 under the laws for the nationalisation of the Aircraft Industry. It grouped together the former Potez, C.A.M.S. and Los Mureaux companies and also took over certain factories belonging to the Breguet concern. M. Henry Potez was the first Administrator.

At the end of 1945 the Société Anonyme des Avions Caudron-Renault was incorporated in the S.N.C.A.N.

Following the liquidation of the S.N.C.A. du Centre in 1949, the Bourges factory of that society was integrated in the Nord group.

On January 1, 1953, the factory at Lyon-Villeurbanne which formerly belonged to the Arsenal del'Aéronautique was taken over by the S.N.C.A.N.

THE N.C. 856.

The N.C. 856 is a development of the N.C. 853 which was designed by the now-defunct Société Nationale de Constructions Aéronautiques du Centre. When the S.N.C.A.C. went into liquidation in 1949, the S.N.C.A.N. took over the factory in which the N.C. 853 was being built and has continued production and development.

Whereas the N.C. 853, which has been described and illustrated in previous issues of this Annual, was produced as a civil two-seat trainer for the S.A.L.S., the N.C. 856A is now in series production for the French Army as a two/three-seat A.O.P. and light liaison aircraft, and is described hereafter. The N.C. 856 can also be supplied as a light ambulance, a glider tug, an agricultural aircraft or as a light four-seat tourer.

TYPE.—Two/three-seat Artillery Observation and Liaison monoplane.

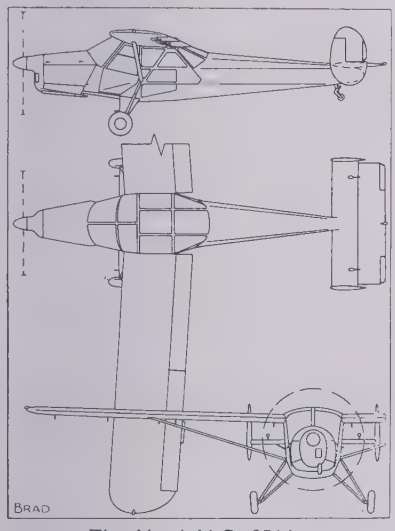
WINGS.—High-wing rigidly-braced monoplane. Aspect ratio 8.6. There is a slight forward sweep to the constant-chord wings. Incidence 4° at root, 3° 30′ at tip. Single-spar metal structure with fabric covering. Single bracing strut on each side. Metal-framed and fabric-covered trailing-edge flaps and ailerons. Each aileron, which is statically balanced, is provided with an all-metal under flap which droops with the main flaps. Gross wing area 16.85 m.² (181 sq. ft.).

FUSELAGE.—Welded steel-tube structure covered with fabric over light wood formers and stringers.

TAIL UNIT.—Braced monoplane type with twin fins and rudders. Metal framework with fabric covering. Single-piece tailplane braced to fuselage by single struts. Single-piece statically-balanced elevator with two automatically-controllable trim-tabs linked with wing flaps. End plate type fins and aerodynamically-balanced rudders each with a tab adjustable on the



Two views of the Nord N.C. 856A (135 h.p. Régnier 4L.04 engine).



The Nord N.C. 856A.

ground only. Span of tail 2.684 m. (8 ft. 9½ in.).

LANDING GEAR.—Fixed tail-wheel type. Oleo-pneumatic shock-absorber struts. Mechanical brakes. Orientable tail-wheel with rubber-cord springing.

POWER PLANT.—One 135 h.p. Régnier 4L.04 four-cylinder in-line inverted air-cooled engine. Controllable-pitch airscrew. Main fuel tank (110 litres=24 Imp. gallons) beneath cabin floor. Electric starter.

ACCOMMODATION.—Cabin seats two side-by-side (pilot on port side) with dual controls, and one centrally behind (A.O.P.) or two side-by-side on bench seat (liaison or touring). Doors on each side alongside front seats, backs of which fold forward for access to rear seats. Triangular door on port side aft for loading of stretcher in ambulance version or for access to baggage compartment, which accommodates radio and camera in A.O.P. version.

DIMENSIONS.—
Span 12.05 m. (39 ft. 6 in.).
Length 7.70 m. (25 ft. 3 in.).
Height 2.225 m. (7 ft. 4 in.).

WEIGHTS (A.O.P.).—
Weight empty 650 kg. (1,430 lb.).
Movable equipment (radio, camera, etc.) 40 kg. (88 lb.).
Crew (2) and parachutes 166 kg. (365 lb.).
Fuel (40 litres) 29 kg. (64 lb.).
Weight loaded 885 kg. (1,947 lb.).

WEIGHTS (Military Liaison).—
Weight empty 650 kg. (1,430 lb.).
Crew (3) and parachutes 249 kg. (548 lb.).
Fuel (110 litres) 80 kg. (176 lb.).
Baggage, etc. 20 kg. (44 lb.).
Weight loaded 999 kg. (2,198 lb.).

WEIGHTS (Ambulance).—
Weight empty 650 kg. (1,430 lb.).
Crew (2) 150 kg. (330 lb.).
Patient and stretcher 90 kg. (198 lb.).
Fuel (110 litres) 80 kg. (176 lb.).
Baggage, etc. 30 kg. (66 lb.).
Weight loaded 1,000 kg. (2,200 lb.).

WEIGHTS (Tourer).—
Weight empty 660 kg. (1,452 lb.).
Crew (4) 300 kg. (660 lb.).
Fuel (110 litres) 80 kg. (176 lb.).
Baggage 20 kg. (44 lb.).
Weight loaded 1,060 kg. (2,332 lb.).

PERFORMANCE (A.O.P.).—
Max speed 190 km.h. (118 m.p.h.).
Cruising speed 170 km.h. (105.5 m.p.h.).
Min. speed 70 km.h. (43.5 m.p.h.).
Initial rate of climb 300 m./min. (984 ft./min.).
Take-off distance to clear 15 m. (50 ft.) 200 m. (218 yds.).
Landing run 90 m. (98 yds.).
Endurance (A.O.P.) 1 hour.
Endurance (liaison) 3 hours.

PERFORMANCE (Ambulance).—
As for A.O.P. version except :—
Min. speed 78 km.h. (48.4 m.p.h.).
Take-off distance to clear 20 m. (66 ft.) 400 m. (437 yds.).
Endurance 3 hours.

PERFORMANCE (Tourer).—
As for A.O.P. version except :—
Min. speed 82 km.h. (51 m.p.h.).
Take-off distance to clear 20 m. (66 ft.) 475 m. (520 yds.).
Endurance 3 hours.

THE NORD 1402 NOROIT.

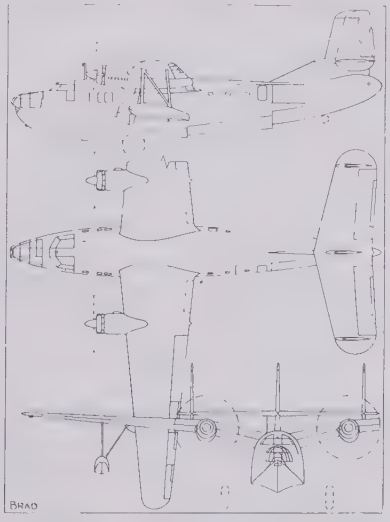
TYPE.—Twin-engined Reconnaissance and Rescue Amphibian Flying-boat.

WINGS.—Cantilever gull-wing monoplane. Aspect ratio 10. All-metal two-spar structure with stressed skin. Hydraulically-operated flaps, of split type between hull and engine nacelles and slotted trailing-edge type outboard of nacelles. Metal-framed fabric-covered slotted ailerons, statically and aerodynamically balanced. Leading-edge slots ahead of outer halves of ailerons. Gross wing area 100 m.² (1,076 sq. ft.).

HULL.—Two-step all-metal hull. Water-rudder ahead of second step. Fixed all-metal stabilising floats under outer wings.

TAIL UNIT.—Cantilever monoplane type with triple fins and rudders. All-metal frames with metal-covered fixed surfaces and fabric-covered control surfaces.

LANDING GEAR.—Retractable tail-wheel type. Main wheels on frames hinged to sides of hull above water-line and when raised hydraulically frames and wheels fair into apertures in sides of hull and undersides of inner wings. Retractable swivelling tail-wheel aft of second step. Track 6.50 m.



The Nord 1402 Noroit.



The Nord 1402 Reconnaissance and Rescue Amphibian (two 2,100 h.p. S.F.E.C.M.A.S. 12H engines).

(21 ft. 4 in.). Wheel base 12.160 m. (39 ft. 10 in.).

POWER PLANT.—Two S.F.E.C.M.A.S 12H (Jumo 213A) twelve-cylinder inverted Vee liquid-cooled engines, each developing a max. continuous output of 1,620 h.p. at 2,700 m. (8,860 ft.) and 1,520 h.p. at 5,100 m. (16,730 ft.) and with 2,070 h.p. available for take-off. Three-blade Ratier variable-pitch, feathering and braking airscrews 4 m. (13 ft. 1 in.) diameter. 14 protected fuel cells in wings. Total capacity 4,800 litres (1,056 Imp. gallons). For long-range rescue missions additional tankage (total 1,770 litres = 390 Imp. gallons) may be provided in compartments in engine nacelles. Provision for four Jato rockets on sides of hull beneath wings and ahead of forward step.

ACCOMMODATION.—Normal crew of seven. Nose compartment for observation and mooring, etc. Flight compartment seats two side-by-side with dual controls. Then follows a large cabin accommodating navigator, radio operator, radar operator and engineer. Aft of this cabin and between two bulkheads is the upper retractable gun turret, two sound-proofed compartments for aircraft auxiliary power units, hydraulic installation and fuelling points. Then follows the rear cabin with bunks, etc. for crew, and on the port side a large sliding door 2 m. (6 ft. 7 in.) wide and 1.20 m. (3 ft. 11 in.) high for use in rescue operations, loading heavy equipment, etc. Gun turret in extreme tail.

ARMAMENT.—Six 20 mm. cannon, two fixed in nose and fired by pilot and two each in two turrets, one dorsal amidships and one in extreme tail of hull. Bomb compartment in engine nacelles beneath wings. Provision for eight rocket projectiles on paired brackets on forward part of hull.

DIMENSIONS.—
Span 31.60 m. (103 ft. 8 in.).
Length 22.04 m. (72 ft. 3½ in.).
Height (on wheels, tail down) 6.85 m. (22 ft. 5½ in.).
Height (tail up) 7.63 m. (25 ft.).

WEIGHTS.—No data.

PERFORMANCE (Reconnaissance Amphibian).—
Max. speed 370 km.h. (230 m.p.h.) at 2,650 m. (8,690 ft.).
Rate of climb at 1,000 m. (3,280 ft.) 300 m./min. (985 ft./min.).

RANGES (Reconnaissance Amphibian).—
2,500 km. (1,550 miles) at 500 m. (1,640 ft.) at 206 km.h. (128 m.p.h.) and 12 hrs. 6 min. duration.

RANGES (Reconnaissance Flying-boat).—
3,000 km. (1,860 miles) at 500 m. (1,640 ft.) at 200 km.h. (124 m.p.h.) and 15 hrs. duration.

RANGES (Rescue Amphibian with auxiliary tanks).—
3,450 km. (2,142 miles) and 18 hrs. duration.

RANGES (Rescue Flying-boat with auxiliary tanks).—
4,200 km. (2,610 miles) and 23 hrs. 24 min. duration.

THE NORD 2501 NORATLAS.

The Nord 2501, which is in production as a military transport for the French Air Force, is also being offered as a civil aircraft suitable for the mixed transport of passengers, bulky freight, vehicles, etc. In the civil version the hold or cabin may be arranged to seat 40 passengers. The cabin is fully sound-proofed, ventilated and heated, while toilet and baggage stowage are provided aft.



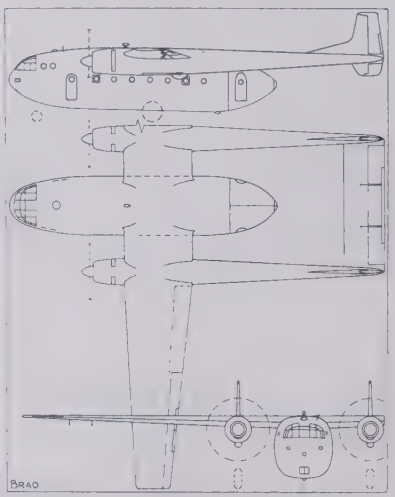
The Nord 2501 Noratlas Military Transport.

TYPE.—Twin-engined Military and Civil Transport.

WINGS.—High-wing cantilever monoplane. Aspect ratio 10.5. All-metal structure. Wing in three sections, comprising a centre-section which carries the engine nacelles and tail booms at its extremities and supports the central fuselage; and two outer sections. Ailerons and flaps on outer sections. Thermal anti-icing with combustion heaters at wing-tips. Wing area 101.2 m.² (1,089 sq. ft.).

FUSELAGE.—The central fuselage, of all-metal construction, accommodates the flight deck and the main hold, Two all-metal booms extending aft from engine nacelles carry the tail-unit. Booms are interchangeable right and left.

TAIL UNIT.—Monoplane type with twin fins and rudders. Fins are integral with tail-booms, tailplane unites the two booms. All-metal structure with metal-covered fixed surfaces and fabric-covered rudders and elevators. Thermal anti-icing for tailplane and fins with single combustion heater on centre-line of tailplane and leading-edge.



The Nord 2501 Noratlas.

LANDING GEAR.—Retractable tricycle type. Main landing-gear units are interchangeable right and left. Track 7.760 m. (25 ft. 5 in.).

POWER PLANT.—Two 2,040 h.p. Bristol Hercules 738 or 758 (without torquemeters) or, optionally, 739 or 759 (with torquemeters) fourteen-cylinder radial air-cooled engines in interchangeable nacelles. Four-blade Rotol controllable-pitch airscrews, non-reversing with Hercules 738 and 739, reversible with Hercules 758 and 759. Fuel tanks carried in centre-section between spars.

ACCOMMODATION.—Flight deck accommodates pilot and co-pilot side-by-side, radio operator and navigator on left and right behind pilots and engineer with folding seat on rear bulkhead. Main hold has reinforced floor and in military version can be arranged to transport freight, wheeled vehicles, troops, paratroops, stretchers, etc. Dimensions of hold: length 9.90 m. (32 ft. 5 in.), max. height 2.75 m. (9 ft.), max. width 2.40 m. (7 ft. 10 in.), volume 51 m.³ (1,800 cub. ft.). Rear end of fuselage is split vertically and hinged to open to full cross-section of hold for direct loading. Small door forward of wing on port side for access to crew compartment. Main cabin door at aft end of hold on port side. For loading of heavy cargo through rear loading doors a "Tirfor" 2-ton winch can be attached to any loading ring on the central row, a roller at the hold sill completing the installation.

DIMENSIONS.—
Span 32.50 m. (106 ft. 7 in.).
Length 21.962 m. (72 ft.).
Height 6.00 m. (19 ft. 8 in.).

WEIGHTS AND LOADINGS (Civil cargo version).—
Weight empty equipped 11,808 kg. (26,032 lb.).
Crew 300 kg. (660 lb.).
Disposable load 7,492 kg. (16,517 lb.).
Weight loaded 19,600 kg. (43,120 lb.).
Wing loading 194.5 kg./m.² (39.87 lb./sq. ft.).
Power loading 4.73 kg./h.p. (10.40 lb./h.p.).



The Nord 2501 Noratlas Military Transport (two 2,040 h.p. Bristol Hercules engines).

PERFORMANCE (at 19,600 kg.=43,120 lb. A.U.W.).—
Max. speed 440 km.h. (273 m.p.h.).
Cruising speed at 1,500 m. (4,920 ft.) 324 km.h. (201 m.p.h.).
Cruising speed at 3,000 m. (9,840 ft.) 335 km.h. (208 m.p.h.).
Rate of climb at S/L. 375 m./min. (1,230 ft./min.).
Rate of climb at 3,000 m. (9,840 ft.) 285 m./min. (935 ft./min.).
Rate of climb on one engine at 1,500 m. (4,920 ft.) 60 m./min. (200 ft./min.).
Service ceiling 7,500 m. (24,600 ft.).
Service ceiling on one engine 2,300 m. (7,545 ft.).
Take-off run 660 m. (720 yds.).
Take-off distance to clear 15 m. (50 ft.) 820 m. (893 yds.).
Landing distance from 15 m. (50 ft.) 790 m. (863 yds.).
Landing run with reversing airscrews 420 m. (459 yds.).

POTEZ

SOCIÉTÉ DES AVIONS ET MOTEURS HENRY POTEZ.

HEAD OFFICE: 46, AVENUE KLEBER, PARIS (XVIe).

WORKS: ARGENTEUIL (S-ET-O).

In 1953 the Société Henry Potez signalised its return to aircraft manufacture, after a lapse of seventeen years, with the appearance of the Potez 75 Army Ground-support monoplane.

The original Potez company was formed during the 1914-18 war and up to the nationalisation of the French aircraft industry in 1936 Potez was one of the largest and most productive of French aircraft manufacturers.

In 1936 the Potez aircraft factories at Méaulte (Somme) and Sartrouville (S-et-O) were incorporated in the Société Nationale de Constructions Aéronautiques du Nord, and that at Berre (Bouches-du-Rhône) in the S.N.C.A. de Sud-Est.

Potez had begun to build aero-engines in 1929 and this branch of the company retained its independence in 1926 under the name of Laboratoire Experimental de Moteurs. After the last war this concern became the Société des Motéurs Potez and in 1953 the name was changed to Société des Avions et Moteurs Henry Potez in order to embrace its widened activities. For details of the aero-engine products of this company see under "Potez" in the Aero-Engine Section.

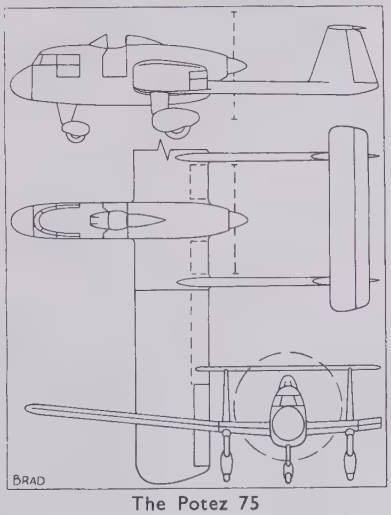
The Potez 75, details of which appear below, was designed by the Potez company and built in the Sartrouville works of the S.N.C.A.N. which, ironically enough, belonged to Potez before nationalisation. The actual construction of the aircraft took only five months.

THE POTEZ 75.

The Type 75 has been designed to meet the requirements of the ground forces as an economical ground support and anti-tank weapon. It is heavily armed and armoured and will be equipped to carry rockets and guided missiles. The prototype flew for the first time on June 10, 1953.



The Potez 75 (450 h.p. Potez 8-D-32 engine).



The Potez 75

TYPE.—Two-seat Ground Support monoplane.
WINGS.—Low-wing cantilever monoplane. All-metal structure. Centre-section carries the nacelle and roots for tail booms. Wing sections outboard of centre-section have dihedral of 4°.
FUSELAGE.—Consists of central all-metal nacelle accommodating crew and pusher engine. All metal tubular tail booms support tail unit.
TAIL UNIT.—One-piece tailplane and inset elevator supported on top of fins integral with tail-booms. All-metal structure.
LANDING GEAR.—Fixed nose-wheel type. Knee-action oleo shock-absorbers to all units.
POWER PLANT.—One 450 h.p. Potez 8-D.32 eight-cylinder inverted Vee air-cooled engine driving a pusher propeller.
ACCOMMODATION.—Enclosed armoured cockpit in nose for observer/weapon control operator. Aft and above is the open cockpit, also armoured for pilot. Nose of nacelle is detachable to permit change of equipment, etc. for various missions.
ARMAMENT.—One fixed heavy-calibre automatic cannon in nose of nacelle. Provision for guided missiles, rockets, etc.
DIMENSIONS.—
Span 13.0 m. (42 ft. 8 in.).
Length 10.0 m. (32 ft. 9½ in.).
WEIGHTS.—
Weight empty (equipped) 1,675 kg. (3,685 lb.).
Weight loaded 2,400 kg. (5,280 lb.).
PERFORMANCE.—
Cruising speed 245 km.h. (152 m.p.h.).
Range 750 km. (465 miles).

S.E.C.A.N.

SOCIÉTÉ D'ETUDES ET DE CONSTRUCTIONS AÉRO-NAVALES.

OFFICE AND WORKS: 40, RUE HENRI BARBUSSE, GENNEVILLIERS (SEINE).

Director-General: Jean Blazy.

The Société d'Etudes et de Constructions Aéro-Navales is a subsidiary of the Usines Chausson, a company well-known in the French automobile industry.

After the war the company undertook the manufacture of all-metal light aircraft, the first example of which was the type S.U.C. 10 Courlis. A series of thirty aircraft was built.

Since 1950 the company has specialised in the manufacture of light alloy and steel components and parts for both aircraft and aero-engines.

It is now producing the "Speedpak" freight container for Constellation airliners under a manufacturing and sales licence from the Lockheed Aircraft Corporation.

The company is manufacturing a demountable tip-tank which can be fitted to the Vampire, F-84 Thunderjet and the M.D. 450 Ouragan. It is also in series production with light alloy tip tanks for the M.D. 450 Ouragan, and steel components for the Hispano-Suiza Tay and Snecma Atar turbojet engines.

S.F.E.C.M.A.S.

SOCIÉTÉ FRANÇAISE d'ETUDES ET DE CONSTRUCTIONS DE MATÉRIELS AÉRONAUTIQUES SPÉCIAUX.

HEAD OFFICE AND WORKS: 12-18, RUE BÉRANGER, CHATILLON-SOUS-BAGNEUX (SEINE).

TEST CENTRES: LES GATINES AND STRASBOURG.

TECHNICAL SCHOOL: VERSAILLES.

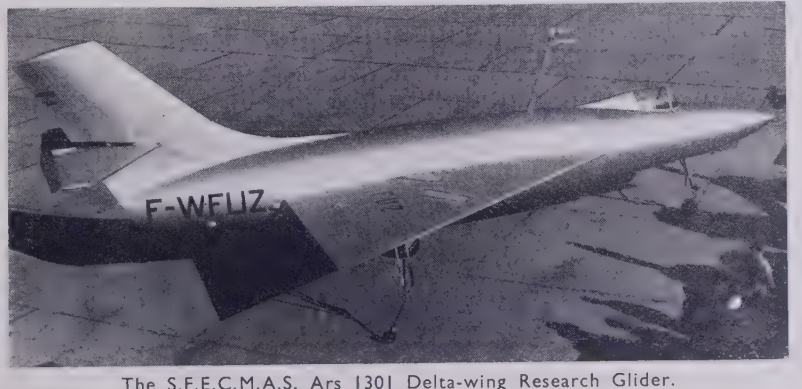
President: M. Vernisse.

This new privately-owned company results from the change of name and status of the Arsenal de l'Aéronautique, which ceased to exist as a Government-owned establishment on December 31, 1952.

The S.F.E.C.M.A.S., whose activities are practically the same as those of the former Arsenal de l'Aéronautique and are continued in the same establishments, is engaged in research and development with airframes, guided missiles, ram-jets and other types of engines, much of which is of a confidential nature.

THE S.F.E.C.M.A.S. Ars 1301.

The Ars 1301 is a piloted engine-less delta-wing flying model which has been



The S.F.E.C.M.A.S. Ars 1301 Delta-wing Research Glider.

built to test the characteristics of this particular wing configuration at low speeds.

It was first towed off the ground by a Dakota on January 17, 1953, and was released at an altitude of 3,000 m. (9,840 ft.), following which it made an 8-minute glide. In subsequent tests a Languedoc has been used as a tug. The greatest height to which the 1301 has been towed by a Languedoc was, up to the time of writing, 6,300 m. (20,665 ft.).

DIMENSIONS.—
Span 8.43 m. (27 ft. 8 in.).
Length 14.26 m. (46 ft. 9½ in.).
WEIGHT LOADED.—1,340 kg. (2,948 lb.).

THE S.F.E.C.M.A.S. Ars 5.501.

The 5.501 is a remotely-controlled pilotless target aircraft which is powered by an Arsenal pulse-jet or "athodyd" developing a thrust of 180 kg. (396 lb.). It closely resembles the German V-1 flying-bomb in general arrangement.

The body is in three sections, a nose section of mild steel housing the automatic pilot and controlling gear; the centre-section, also of mild steel, supporting the cantilever mid-wing surfaces and housing the fuel tanks; and a tail section of light alloy carrying the twin-finned monoplane tail-unit. The pulse-jet power-unit is supported above the rear half of the body by faired vertical struts, the front member enclosing the fuel lines to the engine.

A radio-controlled auto-pilot permits all normal manoeuvres, including turns to right and left, climb, descent, etc. The landing procedure is as follows:—after the engine has been stopped, and when speed has been reduced sufficiently a parachute is released and the remaining fuel is jettisoned.

The 5.501 can be launched from the ground by rockets or released from a mother aircraft in the air.



The S.F.E.C.M.A.S. Ars 5.501 pilotless target on its launching ramp.

DIMENSIONS.—
Span 4.300 m. (14 ft. 1¼ in.).
Length 6.014 m. (19 ft. 8 in.).
Height 1.092 m. (3 ft. 7 in.).
WEIGHTS.—
Weight loaded 660 kg. (1,452 lb.).
PERFORMANCE.—
Speed at 4,000 m. (13,120 ft.) 460 km.h. (286 m.p.h.).
Climb to 4,000 m. (13,120 ft.) 10 min.
Range 320 km. (200 miles).

SIPA

SOCIÉTÉ INDUSTRIELLE POUR L'AÉRONAUTIQUE.

HEAD OFFICE AND WORKS: 1, PLACE EUGÈNE-SUE, SURESNES (SEINE).

This Company was formed in 1938. Until 1940 it was engaged in the manufacture of parts and components for Lioré-et-Olivier, Amiot and Morane aircraft and the overhaul of Mureaux aircraft for the French Air Ministry.

Its first post-war production was the S.10, the French version of the Arado Ar 396. This was followed by the S.11 and S.111, which are modified versions fitted with the Renault 12S (the French-built Argus As 411), and the S.12 which is entirely of metal construction. The company is now producing fifty S.121 trainers, this model differing in only minor details from the S.12. This last-mentioned order brings the total number of aircraft in this series (S.10, S.11, S.111, S.12 and S.121) which have been built for the French Air Force to 234.

The SIPA 901 was selected by the Government for use in the schools of the Service de l'Aviation Légère et Sportive and a production order for 100 was completed in 1952.

The latest SIPA product is the 200, a light two-seat jet-propelled trainer which flew for the first time in January, 1952.

THE SIPA 300R.

SIPA entered two designs for a recent trainer contest organised by the S.A.L.S., one powered by a piston engine and the other jet-powered. The latter, the 300R, is being built in prototype form.

The 300R will be a conventional all-metal low-wing monoplane with retractable tricycle landing-gear and tandem cockpits under a continuous canopy.

The engine, a Turmobéca Palas, will be mounted in the lower part of the forward fuselage with the jet-pipe exit just aft of the trailing-edge of the wing. Air will be supplied to the engine through scoops on the sides of the fuselage forward of the wing.

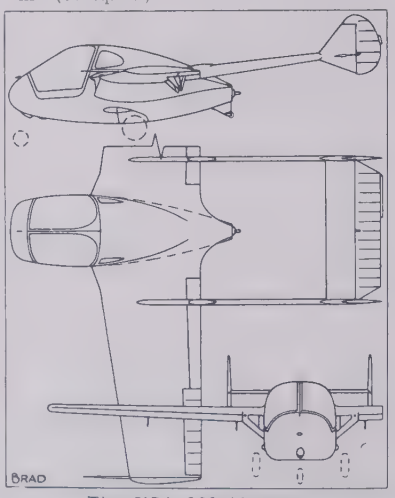
No further details were available at the time of writing.

THE SIPA 200 MINIJET.

The SIPA 200 is a small two-seat jet-propelled aircraft which is intended to serve as a light high-speed liaison aircraft or a basic jet trainer. The first airframe was exhibited at the 1951 Paris Aero Show and was later used for static tests. The second aircraft to be built flew for the first time on January 14, 1952, 347 days after the design was begun.

The second prototype 200 is fitted with a Turbomeca Palas II engine (160 kg.= 350 lb. s.t.), wing-tip tanks and is stressed for aerobatics as a two-seater.

TYPE.—Two-seat light monoplane.
WINGS.—Mid-wing cantilever monoplane. Laminar-flow wing section. Dihedral 3°. All-metal structure. Double slotted Fowler type flaps. Aero-dynamically-balanced slotted ailerons. Gross wing area: 8.90 m.² (97 sq. ft.).



The SIPA 200 Minijet.

FUSELAGE.—All-metal nacelle and two metal tail booms.
TAIL UNIT.—Tailplane and single elevator mounted between extremities of tail booms, which each terminate in fin and rudder. All-metal structure. Tailplane span: 2 m. (6 ft. 8 in.).
LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Hydraulic shock-absorber struts and wheel-brakes. Track: 1.23 m. (4 ft. 1 in.).
POWER PLANT.—One Turboméca Palas I turbojet engine (150 kg.=330 lb. s.t.) mounted in aft section of central nacelle behind a fireproof bulkhead. Air intakes in wing roots.
ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. May also be flown as aerobatic single-seater.
DIMENSIONS.—
Span 7.20 m. (23 ft. 8 in.).
Length 5.12 m. (16 ft. 11 in.).
Height 1.78 m. (5 ft. 10 in.).
WEIGHTS AND LOADINGS.
Weight empty 430 kg. (950 lb.).
Crew (2) 166 kg. (365 lb.).
Fuel and oil 163 kg. (359 lb.).
Weight loaded 759 kg. (1,675 lb.).
Wing loading 85.2 kg./m.² (17.46 lb./sq. ft.).
PERFORMANCE.—
Max. speed at S/L. 400 km.h. (248 m.p.h.).
Cruising speed at 1,000 m. (3,280 ft.) 360 km.h. (223 m.p.h.).
Initial rate of climb 5.75 m./sec. (1,140 ft./min.).
Max. ceiling 8,000 m. (26,240 ft.).
Range (without tip tanks) 550 km. (340 miles).
Take-off run 300 m. (328 yds.).

THE SIPA 901.

TYPE.—Two-seat Light Training monoplane.
WINGS.—Low-wing cantilever monoplane. Single-spar all-wood structure with plywood covering forward of the spar forming a torsionally-stiff D-girder. Fabric covering aft of the spar. Slotted ailerons and



The SIPA 200 Minijet (Turboméca Palas turbojet engine).

trailing-edge flaps are fabric-covered. Wing area 11.2 m.² (120.5 sq. ft.).

FUSELAGE.—Wood four-longeron framework covered with plywood forward and fabric aft.

TAIL UNIT.—Cantilever monoplane type. Wood framework, tailplane plywood-covered, remainder covered with fabric. Trim-tab in port elevator. Automatic tab interconnected with flaps in starboard elevator.

LANDING GEAR.—Fixed tail-wheel type. Cantilever oleo-pneumatic long-stroke shock-absorber legs. Hydraulic wheel brakes. Steerable tail-wheel on oleo spring shock-absorber.

POWER PLANT.—One 75 h.p. Minie 4 DC 30 or 32 four-cylinder horizontally-opposed air-cooled engine driving two-blade fixed-pitch airscrew. Fuel tank in fuselage behind fireproof bulkhead.

ACCOMMODATION.—Enclosed cockpit seating two side-by-side with dual control. Moulded windscreen and sliding moulded canopy. Baggage compartment behind seats.

DIMENSIONS.—
Span 8.75 m. (28 ft. 8 in.).
Length 5.76 m. (18 ft. 10½ in.).
Height 1.75 m. (5 ft. 9 in.).

WEIGHTS AND LOADINGS.—
Weight empty 366 kg. (805 lb.).
Disposable load 234 kg. (515 lb.).
Weight loaded 600 kg. (1,320 lb.).
Wing loading 51.5 kg./m.² (10.55 lb./sq. ft.).
Power loading 8 kg./h.p. (17.6 lb./h.p.).

PERFORMANCE.—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed (70% power) 175 km.h. (108.6 m.p.h.).
Landing speed 70 km.h. (43.5 m.p.h.).
Initial rate of climb 150 m./min. (492 ft./min.).
Service ceiling 4,000 m. (13,120 ft.).
Range in still air 500 km. (310 miles).
Take-off to clear 20 m. (66 ft.) 310 m. (338 yds.).
Landing distance from 20 m. (66 ft.) 320 m. (350 yds.).
Landing run 107 m. (117 yds.).



The SIPA 901 (75 h.p. Minié engine).

THE SIPA S.12.

TYPE.—Two-seat Advanced Trainer.

WINGS.—Low-wing cantilever monoplane. All-metal structure. Centre-section, integral with centre portion of fuselage, has steel framework, outer wings of light alloy. Wing structure comprises a central torsion-box type spar to which the leading and trailing-edge sections are attached. All-metal trailing-edge flaps inboard of ailerons. Ribless corrugated-skin slotted ailerons. Total area of flaps 1.42 m.² (15.28 sq. ft.). Total aileron area: 1.684 m.² (18.12 sq. ft.). Gross wing area: 18.30 m.² (197 sq. ft.).

FUSELAGE.—All-metal structure. Centre-section has steel framework, rear section a light alloy monocoque.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Movable surfaces are of rib-less construction with corrugated skin. Total area of vertical surfaces 1.510 m.² (16.25 sq. ft.). Total area of horizontal surfaces 3.472 m.² (3.74 sq. ft.). Span of tail 3.90 m. (12 ft. 9 in.).

LANDING GEAR.—Retractable tail-wheel type. Main units retract backwards, legs turning through 90° for wheels to be flush with underside of wing. Non-retracting tail-wheel.

POWER PLANT.—One 600 h.p. Renault 12.S.02 twelve-cylinder inverted Vee air-cooled engine. Three-blade Ratier variable-pitch airscrew 2.650 m. (8 ft. 8 in.) diameter. Two fuel tanks with total capacity of 335 litres (74 Imp. gallons).

ACCOMMODATION.—Tandem seats under continuous canopy with sliding sections over seats. Dual controls, including those for landing-gear, flaps, airscrew, control tabs, etc. Identical flight instrument panels in both cockpits.

ARMAMENT AND EQUIPMENT.—Advanced flying training equipment may include machine-gun or camera gun, blind and night flying equipment, radio, etc.

DIMENSIONS.—
Span 11.0 m. (36 ft. 1 in.).
Length 9.328 m. (30 ft. 7 in.).
Height (tail down) 2.45 m. (8 ft.).

WEIGHTS.—
Weight empty 1,863 kg. (4,099 lb.).
Crew (2) 177 kg. (389 lb.).
Fuel and oil 270 kg. (594 lb.).
Miscellaneous 15 kg. (33 lb.).
Weight loaded 2,325 kg. (5,115 lb.).

PERFORMANCE.—
Max. speed at S/L. 320 km.h. (200 m.p.h.).
Max. speed at 2,400 m. (7,870 ft.) 360 km.h. (224 m.p.h.).
Cruising speed at 2,400 m. (7,870 ft.) 320 km.h. (200 m.p.h.).
Initial rate of climb 450 m./min. (1,476 ft./min.).
Climb to 6,000 m. (19,680 ft.) 15 min.
Service ceiling 8,000 m. (26,240 ft.).
Take-off run 160 m. (175 yds.).
Cruise duration 3½ hours.



The SIPA S.12 Advanced Trainer (600 h.p. Renault 12.S engine).

STARCK

AVIONS ANDRÉ STARCK.

HEAD OFFICE AND WORKS: 79, RUE DU POINT-DU-JOUR, BOULOGNE-BILLANCOURT (SEINE).

Avions André Starck, which has designed and built a number of light touring and training aeroplanes since the war, is no longer building complete aircraft. Its most recent design, the A.S. 80, is being supplied in kit form for amateur constructors.

THE STARCK A.S. 80 HOLIDAY.

TYPE.—Two-seat Light Cabin monoplane.

WINGS.—High-wing braced monoplane. Two-spar wood structure covered with fabric. Vee bracing struts. Wing area 15.5 m.² (166.7 sq. ft.).

FUSELAGE.—Rectangular wood structure covered with fabric.

TAIL UNIT.—Braced monoplane type. Wood frames, fabric covering.

LANDING GEAR.—Fixed type. Two faired Vees and two half axles, the latter hinged to Vee cabane beneath fuselage. Rubber cord springing. Low-pressure wheels. Spring steel tail-skid.

POWER PLANT.—One 75 h.p. Régnier four-cylinder in-line inverted air-cooled engine. Alternative power-units may include the 65 h.p. Continental, 75 h.p. Minié, 59 h.p. Salmson, 85 h.p. Salmson, 75 h.p. Praga or 65 h.p. Walter Minor. First prototype fitted with the 75 h.p. Régnier and the second with the 65 h.p. Continental.

ACCOMMODATION.—Enclosed cabin seating two in tandem with dual controls.

DIMENSIONS.—
Span 10 m. (32 ft. 10 in.).
Length 6.60 m. (21 ft. 7½ in.).
Height 1.90 m. (6 ft. 3 in.).

WEIGHTS (75 h.p. Régnier engine).—
Weight empty 327 kg. (720 lb.).
Weight loaded 550 kg. (1,210 lb.).

PERFORMANCE (75 h.p. Régnier engine).—
Max. speed 158 km.h. (98 m.p.h.).
Cruising speed 142 km.h. (88 m.p.h.).
Landing speed 66 km.h. (41 m.p.h.).
Initial rate of climb 180 m./min. (590 ft./min.).
Service ceiling 5,600 m. (18,400 ft.).
Cruising range 315 km. (200 miles).



The Starck A.S.80 Holiday (75 h.p. Régnier engine).



The Sud-Est Sea Venom Naval Shipboard Fighter (D.H. Ghost turbojet engine).

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DE SUD-EST (S.N.C.A.S.E.).

HEAD OFFICE: 6, AVENUE MARÇEAU, PARIS (VIIIe).

WORKS: LA COURNEUVE (SEINE), TOULOUSE (HAUTE-GARONNE), MARIGNANE (NEAR MARSEILLE) AND CANNES (ALPES-MARITIMES).

President-Director General: Georges Hereil.

Director of Production: Louis Giusta.

Commercial Director: M. Detard.

Technical Director: André Vautier.

The Société Nationale de Constructions Aéronautiques de Sud-Est was formed on December 21, 1936, in accordance with the Law of Nationalisation of Military Industries. It included factories formerly owned by the Lioré-et-Olivier, Romano and S.P.C.A. Companies. In 1941 it absorbed the factories of the former Société Nationale de Constructions Aéronautiques du Midi.

In 1952 production of the S.E.2010 Armagnac continued. Six of the eight laid down have been delivered and four of these have been operated by T.A.I. Production under licence of the D.H. Vampire Mk. 5 for the French Government has now been superseded by that of the Mistral, the French development of the Vampire with the Hispano Suiza Nene engine. Sud-Est is also building the Sea Venom under D.H. licence for the French Navy. The first Sud-Est Sea Venom made its maiden flight on October 31, 1952.

Aircraft under development include the S.E.210 Caravelle and the S.E.5000 Baroudeur. The S.E.210 twin-jet medium-range airliner project was successful in an official design competition and an order for two prototypes has been placed. The S.E.5000 is a "private venture" light jet fighter with a novel type of take-off trolley and landing skids to enable it to be independent of hard runways and prepared airfields.

In 1952 Sud-Est acquired the manufacturing licence for the Sikorsky S-55 helicopter, to which it has given the name Joyeux Eléphant. The Society is also undertaking the overhaul and repair of, and the production of spare parts for the Republic F-84 Thunderjet.

THE SUD-EST S.E.5000 BAROUDEUR.

The S.E.5000 is a single-seat jet fighter which has been designed to operate independently of airfields with long runways. For take-off it uses a three-wheeled trolley and it lands on skids.

The take-off trolley, of welded steel tubing, reproduces the layout of a nose-wheel landing-gear. All wheels have low-pressure tyres and are sprung by rubber blocks. The rear wheels are fitted with brakes which are operated by the pilot while the aircraft is on the trolley, or automatically after the aircraft has taken off. The trolley can be fitted with six rockets, two or four being used for take-off according to the type of terrain, and two are for emergency use.

The aircraft is mounted on its take-off trolley by a winch-fitted Jeep, which tows the trolley into position and then hauls the aircraft into place. The operation can be completed in under two minutes.

For landing the S.E.5000 is fitted with three retractable skids, two main forward and one auxiliary aft. They are sprung by rubber blocks in both torsion and compression.

All surfaces of the airframe are swept-back. The wings are fitted with leading-edge slats, slotted flaps and air brakes. The vertical tail has a 55° sweep and the horizontal tail a 42° sweep. The tail-plane is adjustable by a two-speed electric jack. The power-unit consists of one Snecma Atar turbojet.

Primarily the S.E. 5000 will be armed as an attack fighter with provision for explosive or Napalm bombs. Alternatively it can be equipped as a light tactical fighter.

It is claimed that the S.E. 5000 will have a performance equal to that of the best existing fighters but that it will be able to operate from airfields with a take-off run of the order of 700 m. (765 yds.).

The S.E.5000 made its first flight on August 1, 1953.

DIMENSIONS.—
Span 10 m. (32 ft. 9½ in.).
Length 13.49 m. (44 ft. 3 in.).
Height (on T.O. trolley) 3.600 m. (11 ft. 9½ in.).
Height (on skids) 3.04 m. (10 ft.).

WEIGHTS AND PERFORMANCE.—
No data available.

THE SUD-EST S.E.210 CARAVELLE.

The S.E. 210 is a medium-range twin-jet airliner, two prototypes of which are under construction to the order of the Secretariat Général de l'Aviation Civile et Commerciale.

TYPE.—Twin-jet Medium-Range Airliner.

WINGS.—Low-wing cantilever swept-wing monoplane. All-metal structure. Gross wing area 146 m.² (1,571 sq. ft.).

FUSELAGE.—Circular section all-metal monocoque structure. Maximum diameter 3.20 m. (10 ft. 6 in.).

TAIL UNIT.—Cantilever monoplane type. All surfaces swept. All-metal construction.

LANDING GEAR.—Retractable nose-wheel type. Twin nose-wheel unit. Each main unit has a four-wheel bogie. Hydraulic retraction. Track of main units (between centre-line of shock struts) 5.28 m. (17 ft. 4 in.). Wheelbase 11.33 m. (37 ft. 2 in.).

POWER PLANT.—Two Rolls-Royce (Hispano-Suiza licence) Avon RA.16 axial-flow turbojet engines (4,080 kg. = 9,000 lb. s.t. each) mounted in nacelles one on each side of the rear fuselage just ahead of tail-unit. Integral wing fuel tanks. Total fuel capacity 20,000 litres (4,400 Imp. gallons).

ACCOMMODATION.—Crew compartment in nose. Main cabin, with maximum accommodation for 70 passengers, pressurised to maintain a cabin atmosphere of 2,500 m. (11,480 ft.) to a height of 13,000 m. (42,640 ft.). Main access to cabin aft through door with integral steps. Cabin floor 2.10 m. (6 ft. 10 in.) above ground level. Freight compartment (18.3 m.³ = 646 cub. ft.) forward with large loading door. Small door within cargo door for crew use. Total crew five, including two cabin attendants.

DIMENSIONS.—
Span 34.30 m. (112 ft. 6 in.).
Length 31.50 m. (103 ft. 4 in.).
Height 8.94 m. (29 ft. 4 in.).



The Sud-Est S.E. 5000 Baroudeur Light Fighter on its take-off trolley.

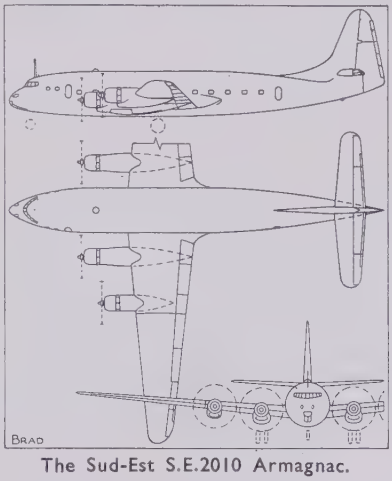


The Sud-Est S.E. 2010 Armagnac Airliner (four 3,500 h.p. Pratt & Whitney R-4360 Wasp-Major engines).

WEIGHTS (Designed).—
Weight empty 19,000 kg. (41,800 lb.).
Weight loaded 37,200-38,400 kg. (81,840-84,480 lb.).
PERFORMANCE (Estimated).—
Cruising speed 730 km.h. (453 m.p.h.) at 10,000-12,000 m. (32,800-39,360 ft.).
RANGES (Estimated).—
At 37,200 kg. (81,840 lb.) take-off weight.
With 7,000 kg. (15,400 lb.) payload 2,500 km. (1,550 miles).
With 3,300 kg. (7,260 lb.) payload 3,920 km. (2,435 miles).
At 38,400 kg. (84,480 lb.) take-off weight.
With 7,000 kg. (15,400 lb.) payload 2,830 km. (1,760 miles).
With 4,500 kg. (9,900 lb.) payload 3,700 km. (2,260 miles).

THE SUD-EST S.E. 2010 ARMAGNAC.

TYPE.—Four-engined Airliner.
WINGS.—Cantilever mid-wing monoplane. Aerofoil section NACA 23017 at root tapering to NACA 23010 at tip. Root chord 7.15 m. (23 ft. 3¼ in.), tip chord 2.01 m. (6 ft. 7 in.). Aspect ratio 10.15. Structure consists of torsion-box formed by spars, hinged leading-edge, and trailing-edge carrying ailerons and slotted variable-camber flaps. Thermal de-icing. Gross wing area 236.25 m.² (2,542 sq. ft.).
FUSELAGE.—Circular-section monocoque structure with Vedal stressed skin. Max. diameter 4.7 m. (15 ft. 5 in.).
TAIL UNIT.—Cantilever monoplane type with dihedral tailplane. Dynamically and statically-balanced rudder and elevators, with trim and balance-tabs in each. Thermal de-icing. Tailplane span 16.25 m. (53 ft. 3 in.).
LANDING GEAR.—Retractable tricycle type. Each main unit carries twin wheels which retract forwards into inner engine nacelles. Nose-wheel carried in full swivelling fork retracts backwards into fuselage. Hydraulic retraction. Track 9.98 m. (32 ft.) on main wheels. Wheelbase: 14.50 m. (47 ft. 7 in.).
POWER PLANT.—Four 3,500 h.p. Pratt & Whitney Wasp-Major R-4360 B13 28-cylinder four-row radial air-cooled engines mounted on interchangeable mountings. Curtiss four-blade constant-speed feathering and reversing airscrews 4.62 m. (15 ft. 2 in.) in diameter. Eight wing fuel tanks with total capacity of 30,600 litres (6,730 Imp. gallons). Oil capacity (four tanks) 1,400 litres (308 Imp. gallons).
ACCOMMODATION.—Pressurized and sound-proofed accommodation seating crew of from seven to eleven and 84 passengers for normal usage and up to 107 for second-class or "coach" accommodation. Passengers in two compartments separated amidships by pantry and bar. Inclinable seats. Cabin atmosphere of 2,500 m. (8,200 ft.) maintained at 6,000 m. (19,680 ft.). Baggage and cargo compartments beneath cabin floor with large external access doors. Volume of cargo compartments 43 m.³ (1,518 cub. ft.).
DIMENSIONS.—
Span 48.95 m. (160 ft. 7 in.).
Length 39.63 m. (129 ft. 10¾ in.).
Height overall 13.37 m. (43 ft. 10 in.).
WEIGHTS.—
Weight empty (84-passenger version) 44,922 kg. (98,828 lb.).



The Sud-Est S.E.2010 Armagnac.

Useful load (payload and fuel) 29,792 kg. (65,542 lb.).
Max. T.O. weight 77,500 kg. (159,500 lb.).
PERFORMANCE.—
Max. speed 530 km.h. (329 m.p.h.).
Cruising speed (65% power) 454 km.h. (282 m.p.h.).
Range with max. payload 2,450 km. (1,520 miles).
Range with max. fuel 5,120 km. (3,180 miles).
Take-off run (no wind) 1,340 m. (1,465 yds.).
Take-off distance to clear 11 m. (35 ft.) 1,810 m. (1,980 yds.).

THE SUD-EST S.E. 3120 ALOUETTE.

The S.E. 3120 is a three-seat general-purpose helicoptor which has been designed with a particular view to its use for agricultural purposes. Other uses envisaged for the S.E. 3120 include reconnaissance, forestry patrol, ambulance to carry pilot and two stretchers, light transport for pilot and two passengers or light freight, etc.

The S.E. 3120 is powered by a 200 h.p. Salmson 9NH engine, which drives the main three-blade rotor and the two-blade anti-torque rotor.

The cabin accommodates the pilot and two passengers or two stretcher cases. For spraying or dusting, the tanks or containers are mounted on the sides of the fuselage one on each side.

The S.E. 3120 made its first flight on July 31, 1952.

On July 2, 1953, the S.E. 3120 established a new international closed-circuit duration record by remaining in the air for 13 hours 56 minutes. It covered a total distance of 1,252 km. (777.5 miles) at an average speed of 108 km.h. (67 m.p.h.).

DIMENSIONS.—
Main rotor diameter 11.60 m. (38 ft.).
Anti-torque rotor diameter 2.0 m. (6 ft. 6 in.).
Length 10.45 m. (34 ft. 3 in.).
Height 2.90 m. (9 ft. 6 in.).
WEIGHTS.—
Weight empty 750 kg. (1,650 lb.).
Disposable load 500 kg. (1,100 lb.).
Weight loaded 1,250 kg. (2,750 lb.).
PERFORMANCE.—
Max. speed 125 km.h. (77.6 m.p.h.).
Rate of climb 270 m./min. (885 ft./min.).
Speed of descent in autorotation 6 m./sec. (19.6 ft./sec.).
Service ceiling 3,600-4,000 m. (11,800-13,120 ft.).
Hovering ceiling 1,300 m. (4,260 ft.).
Endurance at 100 km.h. (62 m.p.h.) 2¼ hours.



The Sud Est S.E. 3120 Alouette Helicopter.



The Sud-Est Mistral Single-seat Fighter (Hispano-Suiza Nene turbojet engine).

THE SUD-EST MISTRAL.

The Mistral is the name given to the de Havilland Vampire Mk. 53 which is being built under licence by Sud-Est.

The Mistral differs from the Vampire 5, from which it was originally developed, by being powered with an Hispano-Suiza Nene 102 turbojet, which, in turn, called for larger air intakes and a modification of the rear fuselage to accommodate the Nene plenum chamber. The fuel system has also been completely re-worked, using a greater number of thinner Marston bullet-proof bag tanks. The Mistral is fabricated with French materials and is fitted largely with French instruments and equipment. It also has an S.N.C. A.S.O. ejection seat of French design and manufacture and the cockpit is pressurised and provided with refrigeration equipment.

WEIGHTS.—
Weight empty 3,480 kg. (7,656 lb.).
Normal loaded weight 4,960 kg. (10,912 lb.).
A.U.W. with wing drop tanks 5,740 kg. (12,628 lb.).

PERFORMANCE.—
Max. speed at S/L. 915 km.h. (568 m.p.h.).
Max. speed at 6,000 m. (19,680 ft.) 896 km.h. (556.4 m.p.h.).
Climb to 12,000 m. (39,360 ft.) 11 min. 3 sec.
Operational ceiling 13,400 m. (43,950 ft.).
Range (without external tanks) 1,390 km. (860 miles).
Range (with external tanks) 1,800 km. (1,120 miles).

SUD-OUEST

SOCIÉTÉ NATIONALE DE CONSTRUCTIONS AÉRONAUTIQUES DU SUD-OUEST (S.N.C.A.S.O.).

HEAD OFFICE : 105, AVENUE RAYMOND-POINCARÉ, PARIS (16e).

WORKS : COURBEVOIE, ROCHEFORT, BOUGUENAIS AND SAINT-NAZAIRE.

Director-General : G. Glasser.

The Société Nationale de Constructions Aéronautiques du Sud-Ouest was formed in 1936 under the Nationalisation Laws. It embraced factories which formerly belonged to the Marcel Bloch, Blériot and Lioré-et-Olivier companies. In 1941 the S.N.C.A. de l'Ouest was merged into the S.N.C.A.S.O., bringing in factories of the former Loire-Nieuport company.

Aircraft at present under development include the S.O. 6021, 6025 and 6026 single-seat experimental jet-propelled fighters, the S.O. 9000, an experimental supersonic aircraft, the S.O. 4050 twin-jet attack monoplane, the S.O. 1120 helicopter, the rotor of which is jet driven by blade-tip combustion chambers, and the S.O. 1220 pure air jet driven helicopter without any combustion at the rotor tips. All these aircraft are described and illustrated hereafter.

THE S.O. 30P BRETAGNE.

The S.O.30P is the production version of an aircraft the original design of which began during the war in unoccupied France. Several protytopes (S.O. 30N, S.O. 30R, etc.) were built and these have been described in previous editions of this Annual.

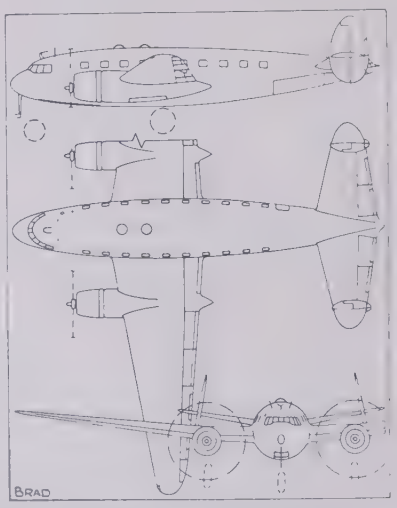
The S.O. 30P, which fulfils all I.C.A.O. requirements, was designed to the recommendations of Air France and the Service Technique Aéronautique Français.

As regards power-plant, two versions are available as follows :-

S.O. 30P-1. Two 2,000 h.p. Pratt & Whitney R-2800-B43 engines driving four-blade Curtiss electric airscrews 4.10 m. (13 ft. 5 in.) diameter. Received its C. of A. in September, 1950. In service with Air-Algérie (6), Air-Maroc (6) and Société de Transport Aérien Extreme-Orient (4) and the Secrétariat Général de l'Aviation Civile et commerciale (2). One is reserved for the use of the President of the Republic.

S.O. 30P-2. Two 2,400 h.p. Pratt & Whitney R-2800-CA18 engines driving three-blade Hamilton Standard constant-speed, automatic-feathering and reversible airscrew with electric de-icing.

One S.O. 30 has been experimentally fitted with two Hispano-Suiza Nene turbojet engines and another with two Snecma Atar 101 turbojet engines. These two versions are separately described.



The Sud-Ouest S.O. 30P Bretagne.

TYPE.—Twin-engined Airliner.

WINGS.—Mid-wing cantilever monoplane. All-metal structure with a two-spar central girder, a detachable leading-edge and a hinged trailing-edge forming the hydraulically-operated flaps and the ailerons. Goodrich de-icing. Aspect ratio 8.40. Gross wing area 86.2 m.² (927.5 sq. ft.).

FUSELAGE.—Circular section all-metal monocoque. The pilot's compartment, passenger cabin, buffet and toilets and the three baggage compartments beneath the cabin floor are pressurised and all skin joints are sealed with rubber.

TAIL UNIT.—Cantilever monoplane type with twin fins and rudders. All-metal structure. Trim-tabs in elevators and rudders. Goodrich de-icing.

LANDING GEAR.—Retractable tricycle type. Hydraulic actuation. Hydraulic brakes on main wheels.

POWER PLANT.—Two 2,000 h.p Pratt & Whitney R-2800-B43 (Mk. 1) or 2,400 h.p. R-2800-CA18 (Mk.2) eighteen-cylinder two-row air-cooled radial engines with two-speed superchargers. Engines mounted elastically on steel-tube mountings in quickly detachable nacelles. Entire cowling hinged in three panels for easy access to entire installation. Fuel system in two interconnected groups comprising, in the outer wings, two integral tanks of 3,120 litres (685 Imp. gallons) and, in the centre-section, two removable tanks of 1,700 litre (375 Imp. gallons). Total fuel capacity 4,820 litres (1,060 Imp. gallons).



The Sud-Ouest S.O. 30P Bretagne Airliner



The Sud-Ouest S.O. 30P Atar Research Aircraft.

ACCOMMODATION.—Crew consists of one or two pilots, engineer, radio operator and steward. Cabin may be arranged to seat from 30 to 43 passengers. Cabin and crew compartment are pressurised, sound-proofed and air-conditioned. Entrance vestibule, toilet, wardrobe and buffet aft of cabin. Three baggage compartments with external access beneath cabin floor. Two additional compartments in the inner wing sections with access doors beneath the wings.

DIMENSIONS.—
Span 26.9 m. (88 ft. 2 in.).
Length 18.95 m. (62 ft. 2 in.).
Height (over tail) 5.90 m. (19 ft. 4 in.).

WEIGHTS (S.O.30P-1—43-pass. version).—
Weight empty and equipped 13,805 kg. (30,430 lb.).
Disposable load (payload and fuel) 5,235 kg. (11,670 lb.).
Payload over 1,000 km. (620 mile) stage at 56% of normal rated power (with ATA fuel reserve) 3,635 kg. (8,010 lb.).
Take-off weight 19,100 kg. (42,200 lb.).

WEIGHTS (S.O.30P-2—43-pass. version).—
Weight empty and equipped 14,080 kg. (31,030 lb.).
Disposable load (payload and fuel) 6,020 kg. (13,270 lb.).
Payload over 1,000 km. (620 mile) stage at 56% of normal rated power (with ATA fuel reserve) 4,150 kg. (9,150 lb.).
Take-off weight 20,100 kg. (44,600 lb.).

PERFORMANCE (S.O.30P-1).—
Cruising speed 415 km.h. (258 m.p.h.) at 6,000 m. (19,680 ft.).
Range with normal tankage (with ATA fuel reserve) 1,390 km. (865 miles); with auxiliary tanks 2,535 km. (1,575 miles).
Take-off distance to clear 15 m. (50 ft.) 1,040 m. (1,140 yds.).
Landing distance from 15 m. (50 ft.) 1,000 m. (1,093 yds.).

PERFORMANCE (S.O.30 P-2).—
Cruising speed 422 km.h. (263 m.p.h.) at 5,800 m. (19,050 ft.).
Range with normal tankage (with ATA fuel reserve) 1,140 km. (710 miles); with auxiliary tankage 2,180 km. (1,358 miles).
Take-off distance to clear 15 m. (50 ft.) 1,090 m. (1,193 yds.).
Landing distance from 15 m. (50 ft.) 1,050 m. (1,142 yds.).
Landing distance from 15 m. (50 ft.) with braking airscrews 790 m. (866 yds.).

THE S.O. 30 NENE.

To an order from the Technical Department of the French Air Ministry, the S.N.C.A.S.O. has equipped one S.O. 30R airframe with two Hispano-Suiza Nene turbojet engines. This aircraft flew for the first time on March 15, 1951.

The S.O.30 Nene is serving as a flying test-bed to investigate the problems raised by the commercial operation of jet aircraft at altitudes up to 10,000 m. (32,800 ft.). For that purpose the aircraft is pressurised to give a cabin altitude of 4,000 m. (13,120 ft.) at an operating altitude of 10,000 m. (32,800 ft.) and a cabin altitude of 2,500 m. (8,200 ft.) at operating altitudes slightly under 10,000 m. (32,800 ft.).



The Sud-Ouest S.O. 30 Nene Research Aircraft.

DIMENSIONS.—
Span 25.8 m. (84 ft. 7 in.).
Length 18.6 m. (61 ft.).
Wing area 84.5 m.² (910 sq. ft.).

WEIGHT.—
Loaded (with 5 tons of fuel) 17,025 kg. (37,500 lb.).

PERFORMANCE.—
Max. speed at 10,000 m. (32,800 ft.) 745 km.h. (475 m.p.h.).
Service ceiling 12,900 m. (39,300 ft.).
Range at 10,000 m. (32,800 ft.) 1,690 km. (1,055 miles).
Take-off distance to clear 15 m. (50 ft.) 1,153 m. (1,260 yds.).

THE S.O. 30P ATAR.

An S.O. 30P airframe has been fitted with two Snecma Atar 101 turbojet engines to augment the research programme initiated with the S.O. 30 Nene previously described. The S.O. 30P airframe is more robust than that of the early prototype S.O. 30R which will permit tests with heavier loads and at greater heights and speeds than could be undertaken with the S.O. 30 Nene.

The S.O. 30P Atar flew for the first time on January 27, 1953.

THE S.O. 4050 VAUTOUR.

The S.O. 4050 is a swept-wing twin-jet aircraft which has been designed for ground support, bombing and all-weather fighting. The first prototype, which flew on October 16, 1952, is fitted with two Snecma Atar 101-B turbojet engines. A second prototype will be powered with the higher-powered Atar 101-C engines. The use of external engine pods below the wings permits the fitting of various types of turbojet engines with ratings up to 4,540 kg. (10,000 lb.) s.t.

A pre-production order for the S.O.4050 was placed by the French Government in 1953. One of the aircraft of this order will be powered by two Armstrong Siddeley Sapphire engines.

The characteristics and performance of the S.O. 4050 were at the time of writing secret, but it can be said that the aircraft was conceived for very high subsonic and trans-sonic speeds in level flight near the ground and at height. The S.O.4050 was the first French twin-jet aircraft to exceed Mach 1.

The general appearance of the S.O. 4050 can be gathered from the accompanying illustration.



The Sud-Ouest S.O. 4050 Vautour (two Snecma Atar 101 turbojet engines).



The Sud-Ouest S.O. 9000 Trident Single-seat High speed Research Monoplane (two wing-tip-mounted Turboméca Marboré II turbojet engines).

THE S.O. 9000 TRIDENT.

The S.O. 9000 is a single-seat research aircraft which in its ultimate form will be powered by both jet and rocket power-units. For the first stage of testing the aircraft is powered by two Turboméca Marboré II turbojet engines (400 kg.= 880 lb. s.t. each) mounted at the wing tips. Later an SEPR rocket motor will be installed in the rear fuselage. Thus powered the S.O.9000 has a designed speed of Mach. 1.6 for a duration of 4½ minutes.

The Trident's wings are of thin laminar-flow section, of low aspect ratio and of constant chord. Other features are an anhedral all-moving tail, a tricycle landing gear retracting into the fuselage, air brakes on the rear fuselage, and an ejectable cockpit.

The S.O. 9000 powered by its two wing-tip turbojets only made its maiden flight on March 2, 1953.

THE S.O. ESPADON (SWORDFISH).

The design of the S.O. 6020 Espadon was begun in 1945 as a single-seat jet interceptor fighter to meet requirements laid down in the first post-war official military aircraft programme. From the original prototype several experimental versions have been developed, the latest being the S.O. 6026, which flew for the first time in October 15, 1951. The various progressive versions are detailed below.

6020-01. First prototype. Jet interceptor fighter design. One Rolls-Royce Nene turbojet with ventral air intake. First flew November 12, 1948. Wing area 25.2 m.² (270 sq. ft.). Gross weight 8,000 kg. (17,600 lb.). Subsequently modified as -02 and fitted, in 1952, with two wing-tip-mounted Turboméca Marboré turbojet engines, for research with this engine configuration.

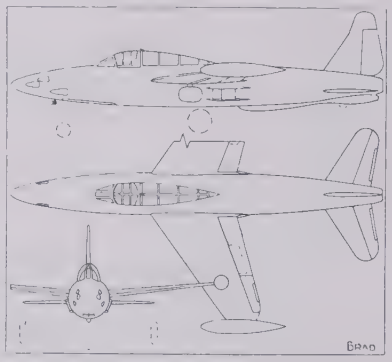
6020 - 02. Second prototype. Flush side air intakes. Raised fin with increased area. First flew December 30, 1949. Now converted to 6026.

6020-03. Third prototype. Modified and re-designated 6025 before it was completed.

6021. Development of 6020-02. Lighter structure. Smaller pressurised and air-conditioned cockpit and ejector seat. Wing area increased to 27.2 m.² (291 sq. ft.). Leduc-Jacottet hydraulic servo controls. Armed with six 20 mm. or four 30 mm. cannon. Mission weight 7,000 kg. (15,400 lb.). Reported to have exceeded Mach. 0.95 in a dive starting at 12,000 m. (39,360 ft.).

6025. This is the 6020-03 re-designated. Ventral intake with double air entries. S.E.P.R. 251 bi-fuel rocket and jettisonable rocket fuel tanks in common fairing between air intakes beneath fuselage. Same equipment and wing area as 6021. Provision in fuselage nose for several types of air cameras. First flew December 28, 1949.

6026. This is the 6020-02 modified and re-designated. Rocket motor in rear end of fuselage under jet tail-pipe. Part of internal tankage and added wing-tip tanks hold rocket fuels. First flew October 15, 1951.



The Sud-Ouest S.O. 6026.

TYPE.—Single-seat Jet-propelled monoplane.

WINGS. — Mid-wing swept-back cantilever monoplane. All-metal structure with stressed metal skin. Slotted flaps and ailerons and leading-edge slots. Flaps hydraulically-operated.

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal construction.

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction.

POWER PLANT.—One Hispano-Suiza Nene turbojet engine in rear fuselage with jet exit aft. Four fuel tanks (2,440 litres=535 Imp. gallons total capacity) feed by gravity a central tank (100 litres=22 Imp. gallons capacity) from which engine is fed by low-pressure pump in tank and two high-pressure pumps on engine.

ACCOMMODATION.—Pressurised cockpit ahead of wing leading-edge. Normal access through hinged and jettisonable panel on starboard side of fuselage, plus retractable ladder. Canopy is also jettisonable and pilot has cordite ejection seat.

DIMENSIONS.—
Span 10.60 m. (34 ft. 9 in.).
Length 15.00 m. (49 ft. 2 in.).

THE S.O. 1120 ARIEL III.

TYPE.—Three-seat jet-driven Helicopter.

ROTOR.—Three-blade rotor on tilting hub. The hub is in the form of a rotating box, sealed by two greased spherical joints, into which the compressed air from the turbo-compressor is fed. The "spider" above the hub which transmits cyclic and collective pitch, is fitted with a fuel filter, fuel atomiser, electric tachometer and flywheel magneto. Fuel and ignition wires are led to the blade roots through flexible lines. Each blade root is attached to the hub by thrust ball-bearing and to each blade by two long leaf springs. The leading-edge of each all-metal rotor blade is a hollow light alloy section through which the compressed air is fed to the streamlined heat-resisting steel combustion chamber which is faired into the blade tip.

FUSELAGE.—Light alloy construction. The central section has as its foundation a flat box structure which contains the fuel



The Sud-Ouest S.O. 6026 Experimental monoplane (Hispano-Suiza Nene turbojet and tail-mounted S.E.P.R. 251 bi-fuel rocket).

tank and supports on its upper surface the turbine-compressor unit bearers, the tubular rotor pylon brackets and the attachment points for the main landing-gear units. A forward extension supports the cabin and nose-wheel attachment. The central section terminates aft with an elliptical ring frame, to which the light tail boom, enclosing the jet tailpipe, is attached.

TAIL UNIT.—Fin and rudder only. Exhaust gases normally ejected from tail-pipe but side outlets controlled by deflector vanes coupled to air rudder provide additional energy for directional control. In auto-rotational flight the air rudder is sufficiently effective for manoeuvrability.

LANDING GEAR.—Nose-wheel type. Three identical knee-action, steel-spring shock struts with completely rotatable wheels.

POWER PLANT.—Turboméca Arius turbine-compressor unit developing 275 s.h.p., supplies compressed air through rotor hub and blades to combustion chambers at rotor tips. Fuel fed at low pressure into hub and delivered by centrifugal force to combustion chambers where mixture is atomised under very high pressure and ignited, the products of combustion being ejected through jet nozzles. Adjustment of air/fuel mixture is automatic and related to turbine r.p.m. Each combustion chamber has spark-plug energised by fly-wheel magneto located in hub. Jet efflux from turbine discharged through stainless steel tail pipe.

ACCOMMODATION.—Enclosed cabin seats three abreast, the centre-seat slightly to the rear. Dual controls to two outer seats. Cabin almost entirely of Plexiglas in light metal frames. Door on each side. Stainless steel bulkhead separates cabin from engine compartment.

DIMENSIONS.—
Rotor diameter 10.80 m. (35 ft. 5 in.).
Length and fuselage 7.15 m. (24 ft. 7 in.).

WEIGHTS.—
Weight empty 680 kg. (1,496 lb.).
Weight loaded 1,250 kg. (2,750 lb.).
Useful load/total weight ratio 0.455.

PERFORMANCE.—
Cruising speed 135 km.h. (105.5 m.p.h.).
Hovering ceiling 1,800 m. (5,900 ft.).
Service ceiling 4,400 m. (14,430 ft.).
Range (with 300 kg.=660 lb. useful load) 250 km. (155 miles).



The Sud-Ouest S.O. 1120 Jet-driven Helicopter (Turboméca Arius turbo-compressor unit).

Range (with 450 kg.=990 lb. useful load) 100 km. (62 miles).

THE S.O. 1220 DJINN.

The S.O. 1220 is an experimental single-seat jet-driven helicopter in which the two-blade rotor is driven by compressed air supplied by a Turboméca Palouste turbo-generator located in the fuselage. Unlike the S.O. 1120 there are no combustion chambers at the rotor blade tips, although the method of conducting the compressed air through the rotor hub and blades to the tip jets is similar. The S.O. 1220 most nearly approaches the ramjet helicopter in simplicity, but its thermodynamic efficiency and its flying qualities, particularly in autorotation, are said to be much superior.

The prototype, which first flew on January 2, 1953, is a simple welded-steel tube test vehicle with an open cockpit, but a mass-production two-seat model is under development.

DIMENSIONS.—
Rotor diameter 8.60 m. (28 ft. 2½ in.).
Fuselage length 4.385 m. (14 ft. 4½ in.).
Height overall 2.37 m. (7 ft. 5 m.).
Skid track 1.85 m. (6 ft. 1 in.).

WEIGHTS.—
Weight empty 270 kg. (594 lb.).
Weight loaded 500 kg. (1,100 lb.).

PERFORMANCE (at 500 kg. = 1,100 lb. A.U.W.).—
Cruising speed 100 km.h. (62 m.p.h.).
Cruising consumption 90 kg./hr. (198 lb./hr.).
Hovering ceiling (without ground effect) 1,000 m. (3,280 ft.).



The Sud-Ouest S.O. 1220 Djinn compressed-air-driven Helicopter

THE S.O. 1310 FARFADET.

The S.O. 1310 is the first French aircraft of the gyrodyne type, that is, one which is able to take-off vertically, hover and land vertically in the manner of a helicopter by means of its rotor, and which may also fly forward at a speed greater than that of the normal helicopter by means of a fixed wing and a propeller which is independent of the rotor. With the S.O. 1310 the translation from rotary-wing to fixed-wing flight is accomplished without any change in the exterior configuration. During forward flight the rotor continues to turn in autorotation at low lift while the fixed wing provides the primary lift.

The S.O. 1310 is also novel in that power is provided by two independent gas-turbine units, a 360 h.p. Turboméca Arius II turbo-compressor, located in the fuselage aft of the cabin, which supplies compressed air to the jet-driven rotor, and a 360 h.p. Turboméca Artouste II turboprop engine which drives a variable-pitch tractor airscrew in the nose of the fuselage. The all-metal three-blade jet-driven rotor is similar to that fitted to the S.O. 1120 Ariel III with small combustion chambers at the rotor tips. The rotor has a diameter of 11.20 m. (36 ft. 8½ in.).

The fixed wing has a span of 6.30 m. (20 ft. 8 in.) and is used as a fuel tank.

The enclosed cabin has accommodation for a crew of two seated side-by-side with dual controls, and either three passengers, two stretcher cases or freight.

The Farfadet first flew as a helicopter on May 8, 1953, and first achieved compound flight on July 1, 1953.



The Sud-Ouest S.O. 1310 Farfadet Gyroplane with nose-mounted turboprop and jet-driven-rotor.

HUNGARY

When the war ended no aircraft manufacturing facilities remained in Hungary. The German armies dismantled and removed all plant and equipment when it evacuated the country.

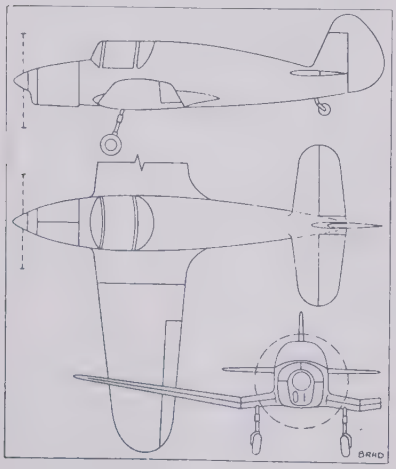
In recent years the Országos Magyar Repülö Egyesület (National Hungarian Aeronautical Association) has played a part in the encouragement of the manufacture of light aircraft of national design, the most important constructional establishment being the Sportarutermelö N.V., or national concern for the production of sporting equipment, which has an aircraft factory at Esztergom.

This factory builds light aircraft and gliders to the designs of Engineer Ernö Rubik. Among the principal Rubik designs are the R.14 Pinty (Finch), the R.15 Koma (Godfather) and R.16 Lepke (Butterfly), the last two being training gliders, the R.17 Móka (Joy) aerobatic sailplane, the R.18 Kánya (Kite) glider-tug and the R.22 Futár (Courier) sailplane.

Other current designs are the M.30 Fergeteg sailplane, the SG.2 Kék Madár (Blue Bird) two-seat light monoplane designed by Samu and Geönczy; the Botond two-seat trainer designed by Nagy and Cserkuti; the Nádi training glider designed by Nagy; the Bene training glider designed by Nagy in collaboration with Bansagi; the Pajtás (Comrade) designed by Lampich; and the Lurko designed by Burodics.

THE SG.2 KÉK MADÁR (BLUE BIRD).

TYPE.—Two-seat Training or Touring monoplane.
WINGS.—Low gull-wing cantilever monoplane. All-wood structure.
FUSELAGE.—Rectangular section all-wood structure with domed decking.
TAIL UNIT.—Cantilever monoplane type.



The SG 2 Kék Madár.

LANDING GEAR.—Fixed type. Cantilever oleo shock struts. Fixed tail-wheel.
POWER PLANT.—One 105 h.p. Hirth HM 504A four-cylinder inverted air-cooled engine.
ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls.
DIMENSIONS.—
Span 9.50 m. (31 ft. 2 in.).
Length 7.50 m. (25 ft. 7 in.).
Height 2.10 m. (6 ft. 11 in.).
WEIGHTS.—
No data.
PERFORMANCE.—
Max. speed 220 km.h. (136 m.p.h.).
Cruising speed 175 km.h. (108.7 m.p.h.).

THE R.18 KANYA (KITE).

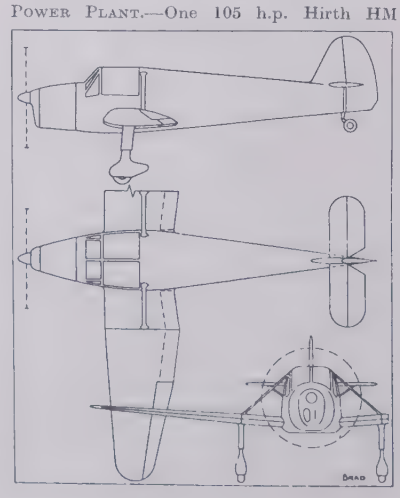
TYPE.—Single-engined Glider-tug.
WINGS.—High-wing braced monoplane. Vee bracing struts. Fixed leading-edge slots and retractable camber-changing flaps. Gross wing area 14 m.² (151 sq. ft.).
FUSELAGE.—Oval section structure of mixed construction.
TAIL UNIT.—Braced monoplane type.
LANDING GEAR.—Fixed divided type. Long-stroke oleo legs with upper ends attached to upper fuselage longerons and the lower ends hinged to the lower longerons by Vee struts. Fixed tail-wheel.
POWER PLANT (Prototype).—One 130 h.p. Walter Major 4-I four-cylinder in-line inverted air-cooled engine. Production aircraft have the 160 h.p. Walter Minor 6-III six-cylinder engine.
ACCOMMODATION.—Enclosed cabin seating two side-by-side, with optional third seat behind.
DIMENSIONS.—
Span 1.6 m. (38 ft.).
Length (prototype) 7.5 m. (24 ft. 7 in.).
Length (production) 7.7 m. (25 ft. 3 in.).
Height (tail up) 2.08 m. (6 ft. 10 in.).
WEIGHTS.—
Weight empty 410 kg. (905 lb.).
Weight loaded 690 kg. (1,520 lb.).
PERFORMANCE (130 h.p. Walter Major 4-I engine).
Max. speed 175 km.h. (108.6 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Economic cruising speed 150 km.h. (93 m.p.h.).
Glider towing speed 80-100 km.h. (50-62 m.p.h.).
Rate of climb 300 m./min. (984 ft./min.).
Rate of climb with glider in tow 270 m./min. (886 ft./min.).
Climb to 1,000 m. (3,280 ft.) 3.5 min.
Climb to 5,000 m. (16,400 ft.) 28.8 min.
Service ceiling 6,000 m. (19,680 ft.).
Range 600 km. (372 miles).
Take-off run (no wind) 96 m. (104 yds.).

THE DARÚ (CRANE).

TYPE.—Two/three-seat Tourer, Trainer or Glider-tug.
WINGS.—High-wing braced monoplane. Vee bracing struts. Fixed leading-edge slots and retractable flaps.
FUSELAGE.—Similar to R.18.
TAIL UNIT.—Braced in monoplane type.
LANDING GEAR.—Fixed divided type. Consists of two side vees incorporating oleo springing, and two half axles, the inner ends of which are hinged to the centre-line of the underside of the fuselage. Fixed tail-wheel.
POWER PLANT.—One 130 h.p. Hirth or 120/130 h.p. Walter Major 4-I four-cylinder in-line inverted air-cooled engine.
ACCOMMODATION.—Enclosed cabin seating two side-by-side with optional third seat behind. Latter not fitted when aircraft is used as a glider-tug.
DIMENSIONS.—
Same as for R.18 Kanya except:
Span 10 m. (32 ft. 9 in.).
WEIGHTS.—
No data available.
PERFORMANCE.—
Max. speed 180 km.h. (112 m.p.h.).
Cruising speed 150 km.h. (93 m.p.h.).
Min. speed with glider on tow 50-55 km.h. (31-34 m.p.h.).

THE BOTOND.

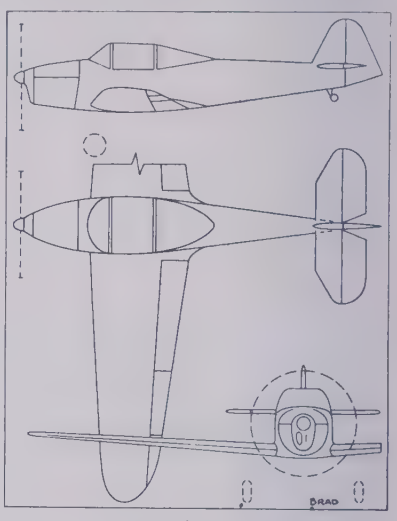
TYPE.—Two-seat Trainer.
WINGS.—Low-wing semi-cantilever monoplane. Entire trailing-edge hinged, with two-piece flaps inboard of ailerons.
FUSELAGE.—All-wood structure.
TAIL UNIT.—Braced monoplane type.
LANDING GEAR.—Fixed type. Cantilever oleo legs and wheel fairings. Fixed tail-wheel.
POWER PLANT.—One 105 h.p. Hirth HM 504A four-cylinder in-line inverted air-cooled engine.
ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls.
DIMENSIONS.—
Span 9.5 m. (31 ft. 2 in.).
Length 8.2 m. (26 ft. 11 in.).
Height (tail down) 1.9 m. (6 ft. 3 in.).
WEIGHTS AND PERFORMANCE.—
No data available.



The Botond Trainer.

THE PAJTÁS (COMRADE).

TYPE.—Two-seat Advanced Trainer.
WINGS.—Low-wing cantilever monoplane. Entire trailing-edge hinged, outer sections as ailerons and inner sections as flaps.
FUSELAGE.—Rectangular section structure.
TAIL UNIT.—Cantilever monoplane type.

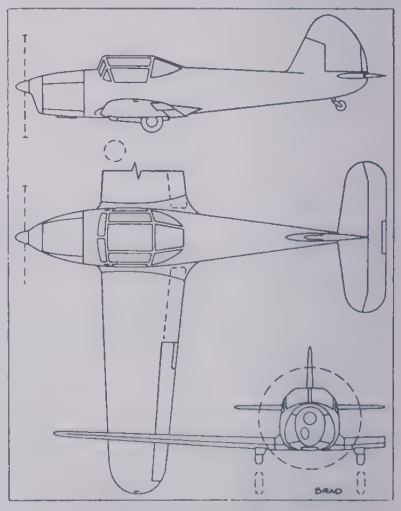


The Pajtás Trainer.

LANDING GEAR.—May be either fixed or retractable, although retractable gear normally fitted. Fixed tail-wheel.
POWER PLANT.—One 105 h.p. Hirth HM 504A four-cylinder in-line inverted air-cooled engine.
ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls.
DIMENSIONS.—
Span about 10 m. (32 ft. 10 in.).
WEIGHTS AND PERFORMANCE.—
No data available.

THE LURKÓ (ROGUE).

TYPE.—Two-seat Trainer.
WINGS.—Low-wing cantilever monoplane.
FUSELAGE.—All-wood rectangular structure
TAIL UNIT.—Cantilever monoplane type.



The Lurkó Trainer.

LANDING GEAR.—Retractable type. Fixed tail-wheel.
POWER PLANT.—One 105 h.p. Hirth HM 504A four-cylinder in-line inverted air-cooled engine.
ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls.
DIMENSIONS, WEIGHTS AND PERFORMANCE.—
No data available.

ITALY

AGUSTA

COSTRUZIONI AERONAUTICHE GIOVANNI AGUSTA.

HEAD OFFICE: CASCINA COSTA, GALLARATE.

Since the war this company has made many attempts to re-establish itself in the aircraft manufacturing field.

It acquired the manufacturing rights of the CP-110 four-seat light cabin monoplane. This aircraft was designed by Ing. Ermenegildo Preti and the prototype was built in the experimental shops of the Milan Polytechnic School. The prototype successfully completed its first trials as a four-seat personal aircraft and these were followed by official evaluation tests by the Italian Air Force but no orders materialised.

In 1952 Agusta obtained the exclusive manufacturing rights for the Bell Model 47 helicopter but up to the beginning of 1953 the company had received no encouragement, official or otherwise, to embark on helicopter production.

Ing. Filippo Zappata has prepared several designs for the company but none has proceeded beyond the project stage.

In the meantime Agusta does overhaul and repair work for the Italian Government.

AMBROSINI

SOCIETA AERONAUTICA ITALIANA, ING. A. AMBROSINI & C.

REGISTERED OFFICE: VIA PALESTRO 68, ROME.

HEAD OFFICE: VIALE MAINO 23, MILAN.

AIRCRAFT WORKS: PASSIGNANO SUL TRASIMENO (PERUGIA).

AERODROME: CASTIGLIONE DEL LAGO.

Chairman and Managing Director: Ing. Angelo Ambrosini.

Aircraft Designer: Ing. Sergio Stefanutti.

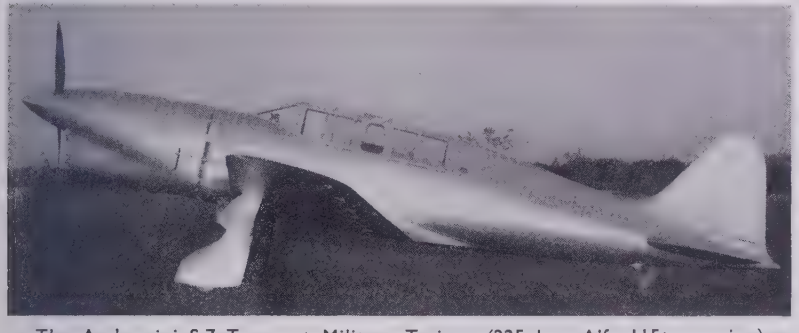
The Societa Aeronautica Italiana was incorporated into the Ambrosini group in 1934. Since that time a long series of touring and training aircraft have been designed and built.

The company's first post-war type was the S.1001 Grifo four-seat touring and training monoplane. This was followed by a two-seat primary trainer development of the Grifo known as the S.1002 Trasimenus. Both these aircraft have been fully described and illustrated in previous editions of "All the World's Aircraft."

The latest and most important product of the company is the S.7 military trainer which may be equipped as either a single-seater or a two-seater. This aircraft which has been ordered in a small series by the Italian Air Force, is described hereafter.



The Ambrosini Super S.7 (380 h.p. D.H. Gipsy Queen 70 engine).



The Ambrosini S.7 Two-seat Military Trainer (225 h.p. Alfa 115*ter* engine).

From the S.7 has been evolved the slightly larger and more powerful Super S.7 which has been developed to provide a complete range of training from the elementary stage to the point where pilots are qualified to join jet operational training units.

THE AMBROSINI SUPER S.7.

The Super S.7 is a slightly larger and more powerful version of the S.7 and has been designed to provide all training requirements up to the stage where pilots are qualified to join operational jet training units.

The general configuration and structure of the Super S.7 are same as for the S.7. The following particulars apply only to the Super S.7.

TYPE.—Two-seat Advanced Trainer.

WINGS.—As for S.7. Aspect ratio 6.2. Mean chord 1.40 m. (4 ft. 7 in.). Aerodynamic airbrakes between ailerons and flaps. Wing area 13.8 m.² (148.5 sq. ft.).

POWER PLANT.—One 380 h.p. D.H. Gipsy Queen Series 70 six-cylinder in-line inverted air-cooled geared and supercharged engine. Three-blade D.H. constant-speed airscrew. Alternatively, the 400 h.p. Alfa 121C eight-cylinder inverted Vee air-cooled geared and supercharged engine driving an SIAI Marchetti constant-speed airscrew may be fitted. Petal-type cowling with flush-type fasteners. When open the four panels of the cowling expose the entire power-plant. Five fuel tanks with total capacity for 220 litres (48.4 Imp. gallons).

ACCOMMODATION.—Enclosed cockpit for two in tandem with dual controls. Canopy in four parts consisting of windshield, front sliding canopy, a middle section and rear sliding canopy. Actuator for opening front canopy mechanically lowers the middle section sufficiently before canopy slides aft. Equipment: complete instrumentation for navigation, night flying, etc. Oxygen equipment. ETR 9-X VHF 10-channel transmitter and receiver, radio range receiver, Lear automatic D/F.

ARMAMENT.—One 7.7 mm. SAFAT machine-gun in port wing. Camera-gun in starboard wing. Racks for two 45-kg. and two 14-kg. bombs and rails for four rockets. Remotely-operated F.24 camera.

DIMENSIONS.—
Span 9.3 m. (30 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 1,376 kg. (3,030 lb.).
Crew (2) 170 kg. (375 lb.).
Military load 229 kg. (505 lb.).
Fuel and oil 177 kg. (390 lb.).
Weight loaded 1,952 kg. (4,300 lb.).
Wing loading 140 kg./m.² (28.7 lb./sq. ft.).
Power loading 5.76 kg./h.p. (12.7 lb./h.p.).

PERFORMANCE (D.H. Gipsy Queen 70 engine).—
Max. speed at S/L. 392 km.h. (245 m.p.h.).
Max. speed at 2,000 m. (6,560 ft.) 427 km.h. (267 m.p.h.).
Economic cruising speed 280 km.h. (175 m.p.h.).
Landing speed (flaps down) 120 km.h. (75 m.p.h.).
Stalling speed (clean) 128 km.h. (80 m.p.h.).
Climb to 5,000 m. (16,400 ft.) 21 min.
Service ceiling 7,625 m. (23,000 ft.).
Cruising endurance 4 hours.

PERFORMANCE (Alfa 121C engine).—
Max. speed at optimum height 448 km.h. (280 m.p.h.).
Climb to 5,000 m. (16,400 ft.) 18 min.
Service ceiling 8,845 m. (29,000 ft.).

THE AMBROSINI S.7.

TYPE.—Single or Two-seat Military Trainer.

WINGS.—Low-wing cantilever monoplane in one piece. NACA 2200 Series wing section with maximum root thickness of 12%. All-wood two-spar structure with plywood skin. Statically and aerodynamically-balanced ailerons. Hydraulically-operated trailing-edge flaps. Gross wing area 12.80 m.² (137.8 sq. ft.).

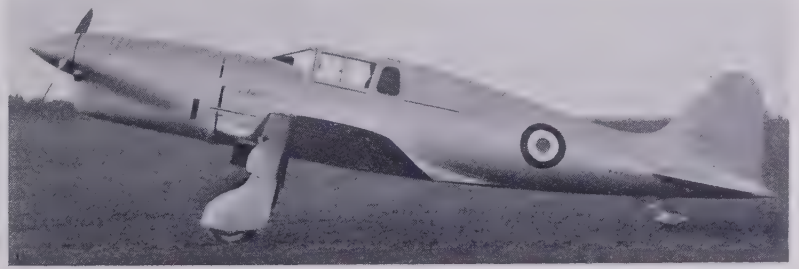
FUSELAGE.—Oval section wood monocoque.

TAIL UNIT.—Cantilever monoplane type. Fin integral with fuselage. Single-piece two-spar plywood-covered tailplane, the incidence of which is adjustable in flight. Movable surfaces have tubular spars, wood ribs and fabric covering.

LANDING GEAR.—Retractable tail-wheel type. Oleo-pneumatic shock-struts. Hydraulic retraction with emergency hand pump. Messier or Magnaghi hydraulic wheel-brakes. Non-retracting tail-wheel has Dowty shock-absorber.

POWER PLANT.—One 225 h.p. Alfa 115*ter* six-cylinder in-line inverted air-cooled engine driving a Fiat-Hamilton or Piaggio two-blade constant-speed airscrew. Fuel system includes three wing tanks with total capacity of 114 litres (25 Imp. gallons) and one fuselage tank with a capacity of 14 litres (3.3 Imp. gallons) in single-seater, or 77 litres (17 Imp. gallons) in two-seater. Provision for installation of a 250 h.p. D.H. Gipsy Queen 30 Series engine in place of Alfa 115*ter*.

ACCOMMODATION.—Enclosed cockpit for one or two, latter with dual controls. Canopies



The Ambrosini S.7 Single-seat Trainer (225 h.p. Alfa 115*ter* engine).

hinge sideways and may be jettisoned in emergency.

EQUIPMENT (Single-seater).—Radio equipment includes SCR.522A VHF receiver and transmitter and BC.1206A LF receiver. F.24 camera. 7.7 mm. SAFAT belt-fed machine-gun in port wing outside airscrew disc.

EQUIPMENT (Two-seater).—Western SCR.27 short-wave radio including two receivers on different wave-lengths and one transmitter. Blind-flying equipment.

EQUIPMENT (common to both versions).—Full night-flying equipment, including landing-light on port landing-gear shock-strut. CO.2 fire-extinguishing system.

DIMENSIONS.—
Span 8.79 m. (28 ft. 10 in.).
Length 8.17 m. (26 ft. 10 in.).
Height 2.80 m. (9 ft.).

WEIGHTS AND LOADINGS (225 h.p. Alfa 115*ter* engine).
Weight empty 1,074 kg. (2,365 lb.).
Disposable load 302 kg. (665 lb.).
Weight loaded 1,376 kg. (3,030 lb.).
Wing loading 107.36 kg./m.² (22 lb./sq. ft.).
Power loading 6.40 kg./h.p. (14.1 lb./h.p.).

WEIGHTS AND LOADINGS (250 h.p. D.H. Gipsy Queen 30 engine).—
Weight empty 1,140 kg. (2,512 lb.).
Disposable load 310 kg. (683 lb.).
Weight loaded 1,450 kg. (3,195 lb.).
Wing loading 113.12 kg./m.² (23.18 lb./sq. ft.).
Power loading 5.81 kg./h.p. (12.8 lb./h.p.).

PERFORMANCE (225 h.p. Alfa 115*ter* engine).—
Max. speed 358 km.h. (224 m.p.h.) at S/L.
Cruising speed 264 km.h. (165 m.p.h.) at 900 m. (2,950 ft.).
Stalling speed 114.4 km.h. (71.5 m.p.h.).
Initial rate of climb 336 m./min. (1,103 ft./min.).
Service ceiling 5,250 m. (1,7220 ft.).
Take-off run 250 m. (273 yds.).
Landing run 220 m. (241 yds.).

PERFORMANCE (250 h.p. D.H. Gipsy Queen 30 engine).—
Max. speed 370 km.h. (230 m.p.h.).
Stalling speed 117.2 km.h. (73.3 m.p.h.).
Initial rate of climb 426 m./min. (1,396 ft./min.)
Service ceiling 5720 m. (18,700 ft.).
Take-off run 225 m. (245 yds.).
Landing run 235 m. (257 yds.).



The Ambrosini Sagittario (Turboméca Marboré turbojet engine).

THE AMBROSINI SAGITTARIO.

The Sagittario is an experimental jet-driven swept-wing monoplane which is being used for aerodynamic research.

Built around a fuselage of the Super 7, the Sagittario has swept wings and tail surfaces, a tail-wheel landing gear and is powered by a Turboméca Marboré turbojet engine (380 kg.=840 lb. s.t.). The engine is mounted in the fuselage nose with direct air entry and with the jet exit beneath the fuselage in line with the wing root trailing-edge.

The first prototype, of all-wood construction, is admittedly an improvisation which was evolved to obtain flight experience with the swept-wing configuration with as little delay as possible. Subsequent prototypes will be of metal construction and several major design changes will be made. These will include redesigning the cockpit and moving it further forward, the fitting of a nose-wheel landing gear, etc.

DIMENSIONS.—
Span 7.50 m. (24 ft. 6 in.).
Length 9.32 m. (30 ft. 6 in.).
Weight loaded.—
2,040 kg. (4,480 lb.).

PERFORMANCE.—
No data available.

THE AMBROSINI F.4 RONDONE.

TYPE.—Two-seat Light Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. All-wood one-piece single-spar structure. Gross wing area 10.60 m.² (114 sq. ft.).

FUSELAGE.—All-wood structure in two sections, the forward section integral with wing.

TAIL UNIT.—Cantilever monoplane type. All-wood structure. Controllable trim-tab in elevator.

LANDING GEAR.—Retractable tricycle type. Hydraulic wheel brakes.

POWER PLANT.—One 65 h.p. Walter Mikron four-cylinder in-line inverted air-cooled engine or 85 h.p. or 90 h.p. Continental C85 or C90 four-cylinder horizontally-opposed air-cooled engine. Two-blade fixed-pitch airscrew, but Aeromatic automatic variable-pitch airscrew may be fitted to Continental C90 engine. Normal fuel capacity 70 litres (15.4 Imp. gallons).

ACCOMMODATION.—Enclosed cockpit seating two side-by-side with dual controls. Baggage compartment behind seats.

DIMENSIONS.—
Span 8.60 m. (28 ft. 2¼ in.).
Length 6.15 m. (20 ft. 2 in.).

WEIGHTS AND LOADINGS (Walter Mikron engine).—
Weight empty 340 kg. (748 lb.).
Disposable load 210 kg. (462 lb.).
Weight loaded 550 kg. (1,210 lb.).
Wing loading 51.8 kg./m.² (10.61 lb./sq. ft.).
Power loading 8.45 kg./h.p. (18.6 lb./h.p.).

WEIGHTS AND LOADINGS (Continental C85 engine).—
Weight empty 390 kg. (858 lb.).
Weight loaded 600 kg. (1,320 lb.).
Wing loading 56.5 kg./m.² (11.58 lb./sq. ft.).
Power loading 7.05 kg./h.p. (15.5 lb./h.p.).

PERFORMANCE (Walter Mikron engine).—
Max. speed 225 km.h. (140 m.p.h.).
Cruising speed 200 km.h. (124 m.p.h.).
Min. speed 75 km.h. (46.5 m.p.h.).
Service ceiling 4,500 m. (14,760 ft.).
Range 750 km. (465 miles).

PERFORMANCE (Continental C85 engine).—
Max. speed 250 km.h. (155 m.p.h.).
Cruising speed 225 km.h. (140 m.p.h.).
Min. speed 80 km.h. (50 m.p.h.).
Service ceiling 5,000 m. (16,400 ft.).
Range 700 km. (435 miles).
Take-off run 110 m. (120 yds.).



The Ambrosini F.4 Rondone (65 h.p. Walter Mikron engine).

CAPRONI

AEROPLANI CAPRONI TRENTO.

HEAD OFFICE AND WORKS: GARDOLO, TRENTO.

General Manager: Giuseppi Raggio.

Chief Engineer: Ing. Stelio Frati.

Aeroplani Caproni Trento, once a comparatively small component of the great group of companies formerly owned and controlled by Count Gianni Caproni, survives to carry on a name which has been associated with Italian aviation since 1908. The parent Caproni company went into liquidation in 1950.

After the war Caproni Trento undertook the repair and maintenance of fighter aircraft, but in 1951 it began the construction of the F.5 two-seat jet-propelled training monoplane designed by Ing. Stelio Frati. This aircraft made its first flight on May 20, 1952.

THE CAPRONI F.5.

TYPE.—Two-seat Jet Trainer.

WINGS.—Low-wing cantilever monoplane. Single main box-spar with front and rear auxiliary spars, the whole covered with plywood. Hydraulically-operated trailing-edge flaps inboard of ailerons. Gross wing area 10 m.² (107.6 sq. ft.).

FUSELAGE.—All-wood structure in two sections bolted together. Forward section containing cockpits integral wing. Rear section accommodates engine and supports tail assembly.

TAIL UNIT.—Cantilever monoplane type. Fin and tailplane are plywood-covered rudder and elevators are fabric-covered. Tailplane span 2.69 m. (8 ft. 10 in.).

LANDING GEAR.—Retractable nose-wheel type. Mechanical retraction. Nose-wheel when retracted partly protrudes so giving protection to engine in event of "wheels-up" landing. Air brake fitted to underside of fuselage.

POWER PLANT.—One Turboméca Palas turbojet engine (150 kg.=330 lb. s.t.) in lower part of fuselage and exhausting beneath



The Caproni F.5 Jet Trainer (Turboméca Palas turbojet engine).

fuselage just aft of trailing edge of wing. "Elephant-ear" air inlets in sides of fuselage above wing. Two fuel tanks, one (5 litres = 1.3 gallon) for gasoline for engine starting outside fuselage, and one (138 litres = 38.8 gallons) for kerosene in fuselage behind second cockpit. Fuel and lubrication systems for inverted flight. Engine compartment insulated with glass-wool. Carbon-dioxide fire-extinguishing system operated by pilot. Outside trolley for engine starting.

ACCOMMODATION.—Tandem enclosed cockpits with dual controls. Pupil in front cockpit. Both canopies may be jettisoned in flight.

EQUIPMENT.—24-volt electrical system. VHF radio transmitter/receiver.

DIMENSIONS.—
Span 7.85 m. (25 ft. 9 in.).
Length 6.60 m. (21 ft. 7½ in.).

WEIGHTS AND LOADINGS.—
Weight empty 470 kg. (1,032 lb.).
Weight loaded 750 kg. (1,650 lb.).
Wing loading 73.2 kg./m.² (15 lb./sq. ft.).

PERFORMANCE.—
Max. speed at S/L. 358 km.h. (224 m.p.h.).



The Caproni F.5 (Turboméca Palas turbojet engine).

Cruising speed at optimum height 387 km.h. (242 m.p.h.).
Climb to 5,000 m. (16,400 ft.) 23 min.
Service ceiling 8,020 m. (26,300 ft.).
Take-off run (with flaps) 280 m. (920 ft.).
Take-off run (without flaps) 384 m. (1,260 ft.).
Landing run (with air brakes and flaps) 150 m. (500 ft.).
Landing run (clean) 242 m. (795 ft.).

FIAT

SOCIETÀ PER AZIONI FIAT.

HEAD OFFICE: CORSO 4 NOVEMBRE 300, TURIN.

Chairman: Prof. Vittorio Valletta.

Director-General: Ing. Gaudenzio Bono.

Chief of Aeronautical Design and Engineering Department: Ing. Giuseppe Gabrielli.

The following branches of the Fiat organization are concerned with the manufacture of aircraft and aero-engines:—

FIAT—SEZIONE AERITALIA.

WORKS: CORSO FRANCIA 366, TURIN.

Director: Ing. Galli Bartolomeo.

Engaged in the construction of aircraft and airscrews.

SOCIETA ANONIMA COSTRUZIONI MECCANICHE AERONAUTICHE (C.M.A.S.A.).

WORKS: MARINA DI PISA.

Normally concerned with the manufacture of flying-boats.

FIAT—SEZIONE MOTORE AVIAZIONE.

WORKS: VIA NIZZA 250, TURIN.

(See Aero-Engine Section).

The direction and technical and commercial departments of the central organization co-ordinates the activities of the three above-mentioned branches, all of which have their own managerial staff.

The Fiat company has made considerable progress in re-establishing itself since the war in the aircraft field. Over 300 G.46's have been built for the Italian and Argentine air forces and a smaller number of G.59's for the Italian Air Force and certain foreign air forces. The latest design of advanced trainer is the G.49, the two prototypes of which were built with different engines and are now in production.

Fiat is now engaged in the production of jet-propelled aircraft. Apart from manufacturing the de Havilland Vampire 52 and Venom under licence, the company has designed and built the G.80 two-seat jet-propelled trainer, which is now in production.

In 1953 an agreement was concluded between the Italian Government, Fiat and North American Aviation, Inc. whereby Fiat will build the North American F-86D all-weather interceptor fighter. Supplementing this agreement, which limits the use of this aircraft to member nations of NATO, the U.S.A.F. has placed an initial order, valued at over twenty-two million dollars, for Fiat F-86D's for service in Europe under the MDAP.

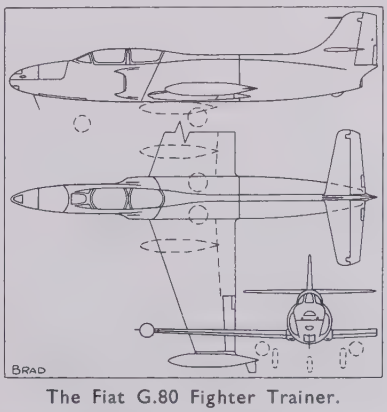
The first fifty aircraft will be assembled largely from parts and components supplied by North American, after which Fiat will assume full responsibility for production of the aircraft, including engines, armament, electronics and other accessories.

THE FIAT G.80.

The G.80 is a two-seat jet fighter trainer and exists in the following versions:—

G.80-1B. Powered with a D.H. Goblin 35 turbojet engine. Prototype. First flew on December 10, 1951.

G.80-3B. Production version of the above, fully equipped for day and night training.



The Fiat G.80 Fighter Trainer.

TYPE.—Two-seat Jet-propelled Trainer.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 4.82. Laminar-flow wing-section. All-metal two-spar structure with swept-back leading-edge and straight trailing-edge. Split flaps inboard of ailerons. Wing area 25 m.² (270.6 sq. ft.).

FUSELAGE.—All-metal monocoque structure in three sections. Oval forward section and circular centre and rear sections. All sections are quickly detachable. Aerodynamic brake in underside of fuselage.

TAIL UNIT.—Cantilever monoplane type. Tailplane mounted on fin. All-metal structure. Tailplane span 4.5 m. (14 ft. 9 in.).

LANDING GEAR.—Retractable tricycle type. Main wheels raised inwardly, the nose-wheel forward. Hydraulic retraction. Hydraulic wheel brakes. Main wheel track 2.25 m. (7 ft. 4½ in.). Wheelbase 4 m. (13 ft. 1 in.).

POWER PLANT.—One D.H. Goblin 35 turbojet engine rated at 1,590 kg. (3,500 lb.) s.t. mounted in fuselage centre-section. Fuel in six tanks, two in centre fuselage and two in each wing. Total internal fuel capacity 1,320 litres (290 Imp. gallons). Two wing-tip auxiliary fuel tanks, each with a capacity of 250 litres (55 Imp. gallons).

ACCOMMODATION.—Tandem enclosed cockpits seating two in tandem with dual controls, pupil in front and instructor behind. Martin-Baker seats and jettisonable cockpit covers. Normalair pressurisation. Full electrical equipment, radio, etc.

ARMAMENT.—Two Browning 0.50 in. machine-guns, one ciné camera gun, two bomb racks, one under each wing, and eight rocket racks, four under each wing, may be installed by fitting suitable adaptors.

DIMENSIONS.—
Span 11.0 m. (36 ft. 1 in.).
Length 12.75 m. (41 ft. 10 in.).
Height 4.04 m. (13 ft. 3 in.).

WEIGHTS AND LOADING.—
Weight empty 4,200 kg. (9,260 lb.).
Normal weight loaded 5,700 kg. (12,570 lb.).
Max. weight loaded 6,200 kg. (13,670 lb.).
Wing loading 227 kg./m.² (46.5 lb./sq. ft.).

PERFORMANCE.—
Max. speed at S/L. 860 km.h. (535 m.p.h.).
Min. speed with flaps down 165 km.h. (103 m.p.h.).
Climb to 3,050 m. (10,000 ft.) 4 min. 5 sec.
Climb to 6,100 m. (20,000 ft.) 9 min. 15 sec.



The Fiat G.80 Two-seat Fighter Trainer (D.H. Goblin 35 turbojet engine).

at 9,000 m. 29,500 ft.
[illegible] hp. 32
[illegible] run 640 m. 1,700 yds.

THE FIAT G.81.

The G.81 is basically the G.80 powered with a Fiat D.H. Ghost [illegible]

THE FIAT G.82.

The G.82 is a further version of the G.80, this time fitted with a Rolls-Royce Nene turbojet.

VERSIONS.—
Same as for G.80.

[illegible] run 490 m. 1,600 ft.

THE FIAT G.84.

The Fiat G.84 is a [illegible]

THE FIAT G.59.

G.59-4A [illegible]

G.59-4B [illegible]



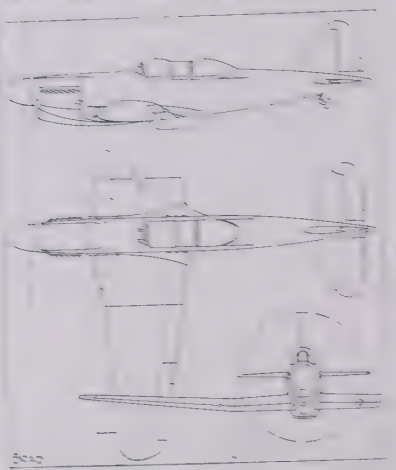
The Fiat G.59-4A Single-seat Advanced Trainer (Rolls-Royce Merlin engine).

engine rated at 1,130 h.p. at 2,850 r.p.m. at 3,030 m. (16,500 ft.) and with 1,400 h.p. available for take-off. Four-blade Fiat-[illegible] 5010 constant-speed airscrew [illegible] 2 in.) diameter. Fuel [illegible] G.59-4A 480 litres (106 Imp. [illegible] gallons, two in fuselage and [illegible] wing. G.59-4B 370 litres [illegible] in five tanks, all in wings. [illegible] 125 litre (27.5 Imp. [illegible] tanks under wings in both [illegible]

ACCOMMODATION.—Single cockpit (G.59-4A) [illegible] cockpits with dual controls [illegible] cockpits with sliding and [illegible] canopies. Oxygen equipment [illegible] and electrical equipment.

[illegible] Two 12.7 mm. (0.50 [illegible] machine-guns with 200 [illegible] Bombs of from 14 kg. [illegible] kg. (350 lb.) may be carried [illegible] wings. Provision for [illegible]

[illegible] .436 lb.).
[illegible] (7,700 lb.).
[illegible] 3,664 kg.
[illegible] kg. m.² (34 lb. sq. ft.).
[illegible] (5.50 lb. h.p.).
[illegible] 2,850 kg. (6,27[illegible]



The Fiat G.59-4B.

Normal loaded weight 3,385 kg. (7,447 lb.).
Max. permissible loaded weight 3,585 kg. (7,887 lb.).
Wing loading 160.5 kg. m.² (32.9 lb./sq. ft.).
Power loading 2.38 kg. h.p. (5.25 lb. h.p.).

PERFORMANCE (G.59-4A).—
Max. speed 593 km.h. (368 m.p.h.) at 6,200 m. (20,400 ft.).
Cruising speed 464 km.h. (290 m.p.h.) at 5,450 m. (17,880 ft.).
Stalling speed with flaps 142 km.h. (88.2 m.p.h.).
Climb to 1,830 m. (6,000 ft.) 1 min. 40 sec.
Climb to 3,660 m. (12,000 ft.) 3 min. 47 sec.
Climb to 5,490 m. (18,000 ft.) 6 min. 14 sec.
Climb to 7,320 m. (24,000 ft.) 9 min. 5 sec.
Service ceiling 11,500 m. (37,700 ft.).
Cruising range 1,000 km. (620 miles) at 5,450 m. (17,880 ft.).

PERFORMANCE (G.59-4B).—
Max. speed 608 km.h. (380 m.p.h.) at 6,400 m. (21,000 ft.).
Cruising speed 458 km.h. (286 m.p.h.) at 5,550 m. (18,200 ft.).
Climb to 1,830 m. (6,000 ft.) 1 min. 48 sec.
Climb to 3,660 m. (12,000 ft.) 3 min. 47 sec.
Climb to 5,490 m. (18,000 ft.) 6 min.
Climb to 7,320 m. (24,000 ft.) 8 min. 32 sec.
Service ceiling 12,100 m. (39,700 ft.).
Cruising range 1,250 km. (780 miles) at 5,550 m. (18,200 ft.).

THE FIAT G.49.

The G.49 is the latest Fiat trainer which has been designed to fulfil all basic training requirements; including day and night flying, instrument and radio-controlled navigation, aerobatic, etc. It is available in the two following versions:—

G.49-1. One 550 h.p. Alvis Leonides 502 4 engine driving a D.H. three-blade constant-speed airscrew.

G.49-2. One 600 h.p. Pratt & Whitney R-1340-S3H1 engine driving a Fiat-Hamilton two-blade constant-speed airscrew.

TYPE.—Two-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. Aspect ratio 6.95. All-metal structure. All-metal split flaps extend from aileron to aileron under fuselage. All-metal ailerons. Gross wing area 24.38 m.² (262.4 sq. ft.).

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Tailplane span 4.3 m. (14 ft. 1 in.).

LANDING GEAR.—Retractable tail-wheel type. Hydraulic retraction. Oleo-pneumatic shock-absorbers. Hydraulic wheel brakes. Track 2.87 m. (9 ft. 5 in.).

POWER PLANT.—One 550 h.p. Alvis Leonides 502 4 (G.49-1) or 600 h.p. Pratt & Whitney R-1340-S3H1 (G.49-2) radial air-cooled engine, the former driving a D.H. three-blade and the latter a Fiat-Hamilton two-blade constant-speed airscrew, both 2.74 m. (9 ft.) diameter. Four thin-walled rubber fuel tanks in centre-section and outer wings. Total fuel capacity 410 litres (90 Imp. gallons). Two drop tanks, 125 litres (27.5 Imp. gallons) each, may be carried under wings.

ACCOMMODATION.—Tandem [illegible]its with dual controls, pupil in front and instructor behind. Sliding jettisonable canopies. Provision for fitting amber screens to front windshield or blind-flying hood. Oxygen [illegible]

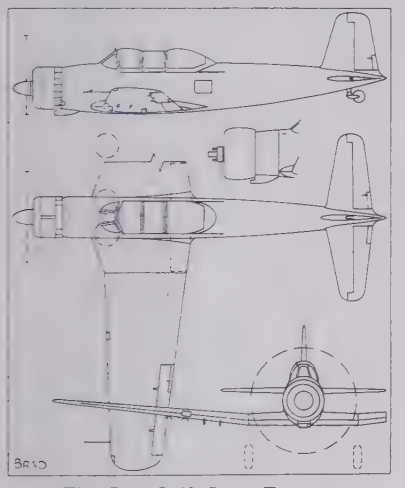
ARMAMENT. SAFAT 7.7 mm. [illegible] wing, [illegible] of one 7.7 mm. (0.30 in.) or 12.7 mm. (0.50 in.) gun in each wing. Electri[illegible] racks for practice bombs or four rockets under each wing.



The Fiat G.59-4B Two-seat Aerobatic Trainer (Rolls-Royce Merlin engine).



The Fiat G.49-1 Basic Trainer (550 h.p. Alvis Leonides engine)



The Fiat G.49 Basic Trainer.

DIMENSIONS.—
Span 13 m. (42 ft. 8 in.).
Length (G.49-1) 9.67 m. (31 ft. 8½ in.).
Length (G.49-2) 9.50 m. (31 ft. 2 in.).
Height (G.49-1) 2.77 m. (9 ft. 1 in.).
Height (G.49-2) 2.65 m. (8 ft. 8½ in.).

WEIGHTS AND LOADINGS.—
Weight empty 2,245 kg. (4,950 lb.).
Weight loaded 2,860 kg. (6,305 lb.).
Wing loading 117 kg./m.² (24 lb./sq. ft.).
Power loading 5.13 kg./h.p. (11.2 lb./h.p.).

PERFORMANCE (G.49-1).—
Max. speed 370 km.h. (230 m.p.h.) at 1,000 m. (3,280 ft.).
Min. speed with flaps 120 km.h. (75 m.p.h.).
Initial rate of climb 360 m./min. (1,025 ft./min.).
Service ceiling 7,000 m. (22,960 ft.).
Normal cruising range (68% power) 1,480 km. (920 miles) at 280 km.h. (175 m.p.h.).

PERFORMANCE (G.49-2).—
Max. speed 370 km.h. (230 m.p.h.) at 1,500 m. (4,920 ft.).
Min. speed with flaps 120 km.h. (75 m.p.h.).
Initial rate of climb 455 m./min. (1,500 ft./min.).
Service ceiling 6,800 m. (22,300 ft.).
Normal cruising range (68% power) 1,110 km. (690 miles) at 310 km.h. (190 m.p.h.).

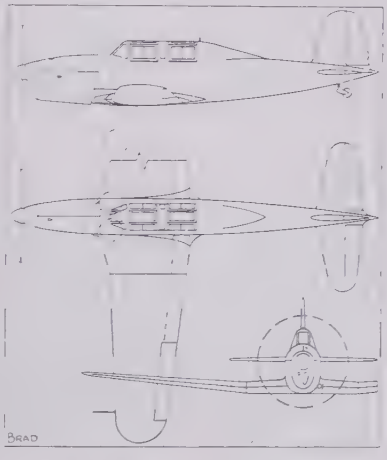
THE FIAT G.46.

The G.46 is available in the following versions:—

G.46-2. One D.H. Gipsy Queen Series 30 six-cylinder in-line inverted air-cooled engine rated at 245 h.p. at 2,500 r.p.m. and with same power for take-off. Fiat-Hamilton constant-speed airscrew.

G.46-4. One Alfa 115-*1ter* six-cylinder engine rated at 215 h.p. at 2,250 r.p.m. and with 225 h.p. for take-off. Fiat-Hamilton constant-speed airscrew. Available in two versions, the G.46-4A single-seat model and the G.46-4B two-seat model.

TYPE.—Two-seat Trainer.
WINGS.—Cantilever low-wing monoplane. All-metal structure with flush-riveted metal covering. Fabric-covered metal ailerons and hydraulically-operated split trailing-edge flaps. Wing area 16 m.² (173 sq. ft.).
FUSELAGE.—All-metal monocoque structure.
TAIL UNIT.—All-metal cantilever monoplane type. Tailplane and fin covered with metal, elevators and rudder with fabric. Trim-tabs in elevators and rudder tab adjustable on ground.
LANDING GEAR.—Retractable tail-wheel type. Oleo-pneumatic shock-absorber struts. Steerable tail-wheel retracts into fuselage. Hydraulic operation.
POWER PLANT.—One 245 h.p. D.H. Gipsy Queen Series 30 (G-46-2) or 225 h.p. Alfa 115-*1ter* (G-46-4) six-cylinder in-line inverted air-cooled engine driving a two-blade constant-speed metal airscrew. Two fuel tanks of 160 litres (35.2 Imp. gallons) capacity in wings.
ACCOMMODATION.—Enclosed cabin seating two in tandem, with dual controls. Hood hinges for access and can be jettisoned. Forward arch reinforced and attached to fuselage as separate structure.
DIMENSIONS.—Span 10.4 m. (34 ft. 1¼ in.).
Length 8.48 m. (27 ft. 10 in.).
Height 2.4 m. (7 ft. 10 in.).
WEIGHTS AND LOADINGS (G.46-2).—
Weight empty 1,110 kg. (2,442 lb.).
Crew (2) 170 kg. (374 lb.).
Fuel and oil 126 kg. (277 lb.).
Equipment 24 kg. (53 lb.).
Weight loaded 1,430 kg. (3,146 lb.).
Wing loading 89.5 kg./m.² (18.35 lb./sq. ft.).
Power loading 5.83 kg./h.p. (12.80 lb./h.p.).
WEIGHTS AND LOADINGS (G.46-4B).—
Weight empty 1,110 kg. (2,442 lb.).
Crew (2) 170 kg. (374 lb.).
Fuel and oil 108 kg. (238 lb.).
Equipment (radio) or baggage 22 kg. (48 lb.).
Weight loaded 1,410 kg. (3,102 lb.).
Wing loading 88.5 kg./m.² (17.14 lb./sq. ft.).
Power loading 6.27 kg./h.p. (13.79 lb./h.p.).
PERFORMANCE (G.46-2).—
Max. speed 327 km.h. (203 m.p.h.).
Cruising speed (8/10 power) 286 km.h. (177.6 m.p.h.).
Min speed (with flaps) 115 km.h. (71.4 m.p.h.).
Initial rate of climb 390 m./min. (1,280 ft./min.).
Climb to 2,000 m. (6,560 ft.) 6 min. 40 sec.
Climb to 4,000 m. (13,120 ft.) 16 min. 55 sec.
Service ceiling 6,050 m. (19,850 ft.).
Absolute ceiling 6,500 m. (21,320 ft.).
Cruising range 920 km. (570 miles).
Take-off run 217 m. (237 yds.).
Landing run (with flaps) 120 m. (186 yds.).
PERFORMANCE (G.46-4B).—
Max. speed 311 km.h. (193.6 m.p.h.).
Cruising speed (8/10 power) 263 km.h. (164 m.p.h.).
Min. speed (with flaps) 107 km.h. (66.7 m.p.h.).
Initial rate of climb 350 m./min. (1,150 ft./min.).
Climb to 2,000 m. (6,560 ft.) 7 min. 23 sec.
Climb to 4,000 m. (13,120 ft.) 20 min. 7 sec.
Service ceiling 5,300 m. (17,400 ft.).
Absolute ceiling 5,700 m. (18,700 ft.).
Cruising range 900 km. (560 miles) at 1,300 m. (4,270 ft.).
Take-off run 225 m. (245 yds.).
Landing run (with brakes) 170 m. (186 yds.).



The Fiat G.46-2 Trainer



The Fiat G.46-2 Trainer (245 h.p. D.H. Gipsy Queen 30 engine).

MACCHI

AERONAUTICA MACCHI S.A.

HEAD OFFICE: CORSO VITTORIO EMANUELE 31, MILAN.
OFFICES AND WORKS: VIA SANVITO SILVESTRO 80, VARESE.
President: Dott. Ing. Paolo Foresio.
General Manager: General Eraldo Ilari.

The Macchi company was founded in 1912 in Varese and its first aeroplane was built in 1913.

Between the wars it established for itself a world-wide reputation as the designers and builders of a series of racing seaplanes. The Macchi 7 flying-boat won the 1921 Schneider Trophy contest, the Macchi 39 the 1926 contest and the Macchi 52*bis* was second in the 1929 contest.

In October, 1933, a Macchi-Castoldi 72 established a World's Speed Record at 709.2 km.h. (440.67 m.p.h.), and this still stands to the credit of Italy as a seaplane record.

Since the end of the war the Macchi company has developed the M.B. 308 two-seat light cabin monoplane, the M.B. 320, a twin-engined six-seat monoplane, and the M.B. 323 trainer. The M.B. 308 is in production and has been supplied to both the Italian Air Force and to the civil air authorities.

Macchi has under development the M.B. 324, a single-seat interceptor fighter powered with a D.H. Ghost engine. No details of this aircraft were available at the time of writing.

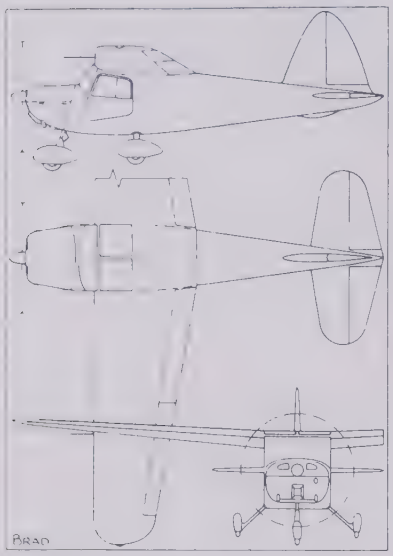
Macchi is taking part in the production programme of the de Havilland Venom and is also building the Fokker S.11 under licence for the Italian Government under the designation M.B. 416.

THE MACCHI M.B. 308.

TYPE.—Two-seat Light Cabin monoplane.
WINGS.—High-wing cantilever monoplane.



The Macchi M.B. 308G Three-seater (90 h.p. Continental C90 engine).



The Macchi M.B. 308.

NACA 230 Series wing section. One-piece monospar wing structure. Main spar of spruce and plywood, the wing forward of the spar being covered with plywood to form a D-section torsionally-stiff structure. Aft of the spar wings are fabric covered. Differentially-operated slotted ailerons. Slotted flaps between ailerons and fuselage. Three flap positions, 15° for take-off, 60° for normal landing and 75° for braked landing. Gross wing area 13.72 m.² (147.6 sq. ft.).

FUSELAGE.—Rectangular wooden structure with spruce framework and plywood covering.

TAIL UNIT.—Cantilever monoplane type. All-wood structure with plywood-covered fin, tailplane and elevators, plywood and fabric-covered rudder. Controllable trim-tab in elevator.

LANDING GEAR.—Fixed tricycle type. Steerable nose-wheel on long-stroke oleo-spring shock-absorber strut attached to sloping engine compartment bulkhead. Main wheels on hinged cantilever struts with rubber-in-compression springing within fuselage. Hydraulic wheel brakes on main wheels.

POWER PLANT.—One 85 h.p. Continental C85 or 90 h.p. Continental C90 four-cylinder horizontally-opposed air-cooled engine. Fuel tank above baggage compartment partly in fuselage and partly in wing. Capacity 80 litres (17.6 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Baggage compartment behind seats and accessible in flight. Entrance door on each side.

DIMENSIONS.—
Span 10 m. (32 ft. 9½ in.).
Length 6.527 m. (21 ft. 5 in.).
Height 2.75 m. (9 ft.).

WEIGHTS AND LOADINGS (Continental C85 engine).—
Weight empty 390 kg. (858 lb.).
Pilot and passenger 150 kg. (330 lb.).
Fuel and oil 67 kg. (147.4 lb.).
Baggage 13 kg. (28.6 lb.).
Weight loaded 620 kg. (1,364 lb.).
Wing loading 45 kg./m.² (9.22 lb./sq. ft.).
Power loading 7.3 kg./h.p. (16 lb./h.p.).

WEIGHTS AND LOADINGS (Continental C90 engine).—
Weight empty 410 kg. (902 lb.).
Weight loaded 650 kg. (1,430 lb.).
Wing loading 47.3 kg./m.² (9.69 lb./sq. ft.).
Power loading 7.21 kg./h.p. (15.86 lb./h.p.).

PERFORMANCE (Continental C85 engine).—
Max. speed 203 km.h. (126 m.p.h.).
Cruising speed (70% power) 175 km.h. (108.6 m.p.h.).
Landing speed 65 km.h. (40.3 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 5 min.
Service ceiling 5,800 m. (19,025 ft.).
Cruising range 780 km. (485 miles).

PERFORMANCE (Continental C90 engine).—
Max. speed 203 km.h. (126 m.p.h.).
Cruising speed (70% power) 170 km.h. (105.5 m.p.h.).
Landing speed 68 km.h. (42 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 3 min.
Service ceiling 6,000 m. (19,680 ft.).
Cruising range 720 km. (450 miles).
Take-off run 100 m. (109 yds.).
Landing run 60 m. (66 yds.).

THE MACCHI M.B.308G.

The M.B. 308 with the 90 h.p. Continental C90 engine is also in production as a three-seater, the third seat being at the back of the cabin. Two small side windows are added for the extra seat.

WEIGHTS.—
Weight empty 430 kg. (946 lb.).
Weight loaded 690 kg. (1,520 lb.).

PERFORMANCE.—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed 167 km.h. (103.7 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 6 min.
Ceiling 3,800 m. (12,460 ft.).
Max. range 540 km. (335 miles).
Take-off run 160 m. (175 yds.).

THE MACCHI M.B. 308 SEAPLANE.

The M.B. 308 in two-seat form is also available as a twin-float seaplane. Fitted with the 90 h.p. Continental C90 engine this aircraft has the following characteristics :—

DIMENSIONS.—
As for M.B. 308 landplane, except length 6.65 m. (21 ft. 10 in.).

WEIGHTS.—
Weight empty 460 kg. (1,012 lb.).
Weight loaded 670 kg. (1,474 lb.).

PERFORMANCE.—
Max. speed 187 km.h. (116 m.p.h.).
Cruising speed 155 km.h. (96.2 m.p.h.).
Stalling speed 68 km.h. (42.2 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 7 min.
Ceiling 3,500 m. (11,480 ft.).
Max. range 550 km. (340 miles).
Take-off run (from water) 220 m. (240 yds.).

THE MACCHI M.B.320.

TYPE.—Twin-engined six-seat monoplane.

WINGS.—Low-wing cantilever monoplane. NACA 230 Series wing section. Aspect ratio 8. Wood single-spar structure with stressed plywood skin. Differentially-controlled slotted ailerons. Slotted flaps between ailerons and fuselage. Leading-edge anti-icing equipment. Gross wing area 21 m.² (226 sq. ft.).

FUSELAGE.—In three sections, a detachable metal nose, and centre and rear sections of wood with plywood stressed skin.

TAIL UNIT.—Cantilever monoplane type. All-wood plywood-covered structure. Trim tabs in starboard elevator and rudder. Anti-icing equipment on tailplane and fin.

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Full-swivelling nose wheel with centre lock and anti-shimmy damper. Hydraulic brakes.

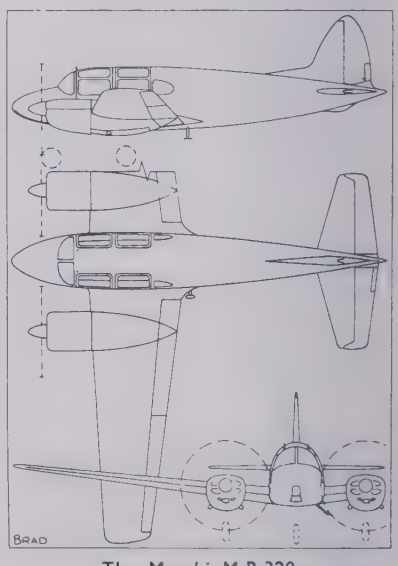
POWER PLANT.—Two 185 h.p. Continental E185 six-cylinder horizontally-opposed air-cooled engines. SIAI mechanically-controlled variable-pitch or Aeromatic automatic constant-speed airscrews. Four fuel tanks, two per engine, in wings aft of spar. Total fuel capacity 400 litres (88 Imp. gallons).

ACCOMMODATION.—Enclosed accommodation for two pilots side-by-side with dual controls and four passengers seated in pairs. Baggage compartment aft of rear seats, which can be removed to increase stowage space if needed. Cabin is soundproofed and air-conditioned. Full electrical equipment.

DIMENSIONS.—
Span 13 m. (42 ft. 7½ in.).
Length 8.65 m. (28 ft. 4 in.).
Height 3.19 m. (10 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 1,490 kg. (3,285 lb.).
Pilot and 5 passengers 450 kg. (990 lb.).
Baggage 45 kg. (99 lb.).
Fuel and oil 217 kg. (48 lb.).
Weight loaded 2,250 kg. (4,960 lb.).
Wing loading 107.1 kg./m². (21.96 lb./sq. ft.).
Power loading 6.08 kg./h.p. (13.37 lb./h.p.).

PERFORMANCE.—
Max. speed 322 km.h. (200 m.p.h.).
Cruising speed (70% power) 285 km.h. (177 m.p.h.) at 2,000 m. (6,560 ft.).
Min. speed 105 km.h. (65.2 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 3 min. 8 sec.
Climb to 2,000 m. (6,560 ft.) 7 min. 30 sec.
Climb to 3,000 m. (9,840 ft.) 12 min. 24 sec.
Climb to 4,000 m. (13,120 ft.) 20 min. 15 sec.
Service ceiling 5,200 m. (17,060 ft.).
Single-engine service ceiling 2,650 m. (8,690 ft.).



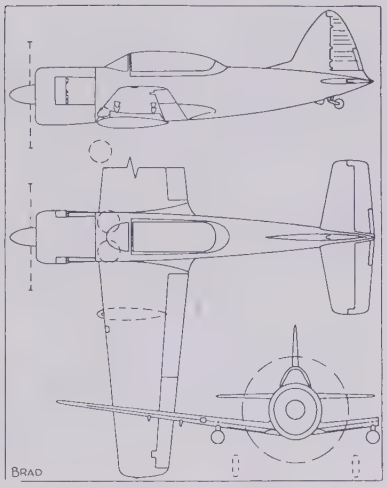
The Macchi M.B.320



The Macchi M.B. 320 (two 185 h.p. Continental E185 engines).



The Macchi M.B. 323 Advanced Trainer (610 h.p. Pratt & Whitney R-1340 engine).



The Macchi M.B. 323 Advanced Trainer.

Cruising range (10 km.h. = 6.2 m.p.h. head wind) 1,000 km. (620 miles) at 260 km.h. (161.5 m.p.h.) at 2,000 m. (6,560 ft.).
Take-off run 260 m. (283 yds.).
Landing run 209 m. (228 yds.).

THE MACCHI M.B. 323.

TYPE.—Two-seat Advanced Trainer.
WINGS.—Low-wing cantilever monoplane. All-metal stressed skin structure. Hydraulically-operated trailing-edge flaps. Gross wing area 22 m.² (236.7 sq. ft.).
FUSELAGE.—All-metal semi-monocoque structure.
TAIL UNIT.—Cantilever monoplane type. All-metal structure. Statically and aerodynamically-balanced control surfaces.
LANDING GEAR.—Retractable tail-wheel type. Hydraulic retraction. Tricycle landing-gear being developed (M.B. 323T).
POWER PLANT.—One 610 h.p. Pratt & Whitney R-1340 nine-cylinder radial air-cooled engine.
ACCOMMODATION.—Crew of two in tandem under a single-piece moulded Perspex sliding canopy. Pupil in front, instructor behind, the latter's seat being higher. Dual controls and complete instrument duplication. Blind-flying screens for pupil. Equipment includes VHF and R/T radio, provision for ILS. One 7.9 mm. machine-gun in port wing, camera gun, racks for practice bombs, camera, etc. may be fitted.
DIMENSIONS.—
Span 12.40 m. (40 ft. 8 in.).
Length 9.80 m. (32 ft. 2 in.).
Height 4.04 m. (13 ft. 3 in.).
WEIGHTS AND LOADINGS.—
Weight empty 1,690 kg. (3,718 lb.).
Crew (2) 170 kg. (374 lb.).
Fuel and oil 328 kg. (722 lb.).
Military equipment 62 kg. (136 lb.).
Weight loaded 2,250 kg. (4,950 lb.).
Wing loading 102.2 kg./m.² (20.95 lb./sq. ft.).
Power loading 3.69 kg./h.p. (8.12 lb./h.p.).
PERFORMANCE.—
Max. speed 374 km.h. (232 m.p.h.) at 2,900 m. (9,510 ft.).
Cruising speed (70% power) 326 km.h. (202 m.p.h.) at 2,000 m. (6,560 ft.).
Min. speed (without flaps) 125 km.h. (77.6 m.p.h.).
Min. speed (with flaps) 107 km.h. (66.4 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 2 min. 2 sec.
Climb to 2,000 m. (6,560 ft.) 4 min. 5 sec.
Service ceiling 7,500 m. (24,600 ft.).
Absolute ceiling 7,900 m. (25,910 ft.).
Range 1,080 km. (670 miles).
Take-off run 200 m. (220 yds.).
Landing run with brakes 210 m. (230 yds.

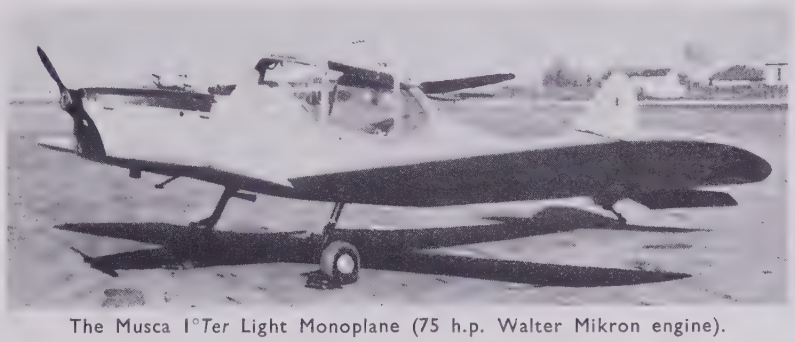
MUSCARIELLO

ING. FRANCO MUSCARIELLO.

ADDRESS: CORSO G. MATTEOTTI, O, TURIN.

Ing. Franco Muscariello was technical manager of Ali Viberti S.p.A. and in that capacity was responsible for the design of the Viberti Musca 1° two-seat light touring and training monoplane, which has been illustrated and described in previous editions of "All the World's Aircraft." The Officine Viberti has now ceased all aeronautical activity and Ing. Muscariello has continued the development of the Musca independently.

The current model is the Musca 1° *Ter* which is derived from the Musca 1° and the Musca 1°/2S and retains the principal characteristics of its predecessors. The Musca 1°*Ter* has, however, a new type of landing-gear and is powered with a 75 h.p. Walter Mikron engine. It is described and illustrated herewith.



The Musca 1°*Ter* Light Monoplane (75 h.p. Walter Mikron engine).

THE MUSCA 1° *Ter*.

TYPE.—Two-seat Light Cabin monoplane.
WINGS.—Low-wing cantilever monoplane. Clark Y wing section. Aspect ratio 7. Dihedral 5°. Incidence 1° 30'. All-wood single-spar structure. Gross wing area 12.60 m.² (135.5 sq. ft.).
FUSELAGE.—All-wood monocoque structure.
TAIL UNIT.—Cantilever monoplane type. All-wood structure.
LANDING GEAR.—Fixed tail-wheel type. Each main unit consists of a rigid tube, to the lower end of which is hinged an articulated member. The forward end of this member is sprung by rubber cord shock-absorber to the main strut while the rear end carries the axle and wheel.
POWER PLANT.—One 75 h.p. Walter Mikron III four-cylinder in-line inverted air-cooled engine. One 60 litre (13.2 Imp. gallon) fuel tank in fuselage.
ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. All-round visibility. Cabin can be adapted to carry one stretcher. The aircraft can also be fitted for crop-spraying.
DIMENSIONS.—
Span 9.50 m. (31 ft. 2 in.).
Length 6.80 m. (26 ft. 1 in.).
WEIGHTS AND LOADINGS.—
Weight empty 370 kg. (814 lb.).
Disposable load 280 kg. (616 lb.).
Weight loaded 650 kg. (1,430 lb.).
Wing loading 51.58 kg./m.² (10.57 lb./sq. ft.).
Power loading 8.6 kg./h.p. (18.9 lb./h.p.).
PERFORMANCE.—
Max. speed 200 km.h. (124.2 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Min. speed 75 km.h. (46.5 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 5 min. 30 sec.
Climb to 2,000 m. (6,560 ft.) 11 min. 30 sec.
Climb to 3,000 m. (9,840 ft.) 20 min.
Cruising range 650 km. (404 miles).
Take-off run at 600 kg. (1,320 lb.) A.U.W. 300 m. (328 yds.).

NARDI

NARDI S.A. PER COSTRUZIONI AERONAUTICHE.

HEAD OFFICE AND WORKS: AEROPORTO FORLANINI, MILAN.

President: Dr. Ing. Luigi Nardi.
Vice-President: Dr. Elto Nardi.

This concern was established by the four Nardi brothers in Milan in 1933. Their first product, the F.N. 305, first flew in 1935.

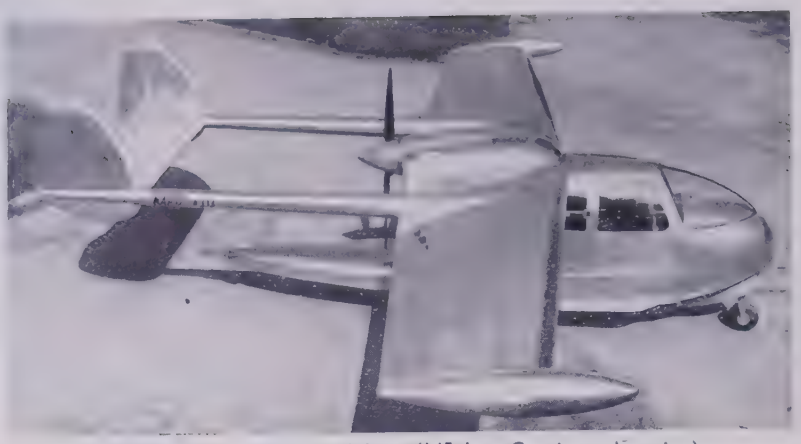
The Nardi factory at Loreto was almost completely destroyed during the war but the Milan factory has been rebuilt and the company has now completed its first post-war aircraft, the FN-333 three-seat all-metal amphibian, which flew for the first time on December 4, 1952. It is now developing the FN-333-S, a four-seat version with a higher-powered engine and folding wings, which will be the ultimate production model.

In addition to aircraft manufacture, the company has specialised in the production of wheels, brakes, retractable landing gears, hydraulic and electric aircraft controls, fuel pumps, armament installations and aircraft accessories generally. The Nardi company is the agent and licensee of the American Bendix and British Dunlop companies for landing-gears, wheels, brakes and hydraulic mechanisms for brakes, landing-gear retraction, etc.

The company is also included in the list of firms approved by the Aeronautical inspection Directorate of the British Ministry of Supply.

THE NARDI FN-333.

TYPE.—Three-seat boat Amphibian.
WINGS.—Shoulder-wing cantilever monoplane. Two-spar all-metal construction. Centre-section, attached to hull, carries tail-booms and engine mounting. Statically and aerodynamically balanced ailerons. Split flaps inboard of ailerons. Gross wing area 13.5 m.² (145.26 sq. ft.).
HULL.—Single-step all-metal structure. Hull below cabin floor has series of watertight compartments. Deck of rear portion provided with manholes and drain openings. Rudder hinged to sternpost.



The Nardi FN-333 Amphibian (145 h.p. Continental engine).

TAIL BOOMS.—Each is a tapered tube made from a single duralumin sheet. Bolted to wing centre-section through flanged duralumin collars.

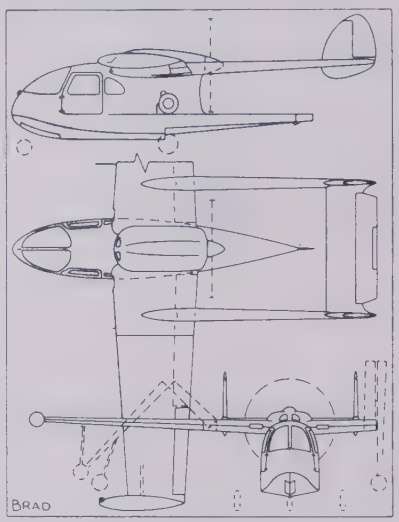
TAIL UNIT.—Rectangular tailplane between ends of booms. Upper and lower fins riveted to booms. Statically and aerodynamically balanced elevator has central controllable trim-tab. Aerodynamically-balanced rudders. Entire tail-unit is of metal construction. Tailplane span (centre-line of booms) 2.50 m. (8 ft. 2 in.).

LANDING GEAR. — Retractable nose-wheel type. Two main units are independent but are retracted by a single hydraulic jack. When retracted each unit is entirely buried in side of hull. Oleo-pneumatic shock-struts. Wheels are of peralumin anti-corrosive alloy and have Bendix-type hydraulic disc brakes. Main wheel track 1.96 m. (6 ft. 5 in.). Wheelbase 2.65 m. (8 ft. 8 in.).

WING TIP FLOATS.—Retractable floats are of peralumin alloy and are carried on single struts. Hydraulic retraction. When raised are located at wing-tips.

POWER PLANT.—One 145 h.p. Continental horizontally-opposed fan-cooled engine buried in centre-section. Aeromatic automatically adjustable-pitch pusher propeller with armoured wood blades. Electric starter. One 100 litre (22 Imp. gallons) fuel tank in hull behind cabin.

ACCOMMODATION.—Cabin seats three, two side-by-side in front with dual controls and one behind. Sound-proofed, air-conditioned and heated cabin. Large door on each side and backs of front seats hinge forward to give access to rear seat. Radio. Electric position indicators for landing-gear, flaps and wing-tip floats.



The Nardi FN-333-S Amphibian.

DIMENSIONS.—
Span (over wing-tip floats) 10.0 m. (32 ft. 9¼ in.).
Length of hull 5.5 m. (18 ft.).
Overall length 7.0 m. (22 ft. 11 in.).
Height 2.66 m. (8 ft. 9 in.).

WEIGHTS AND LOADINGS.—
Weight empty 584 kg. (1,285 lb.).
Disposable load 306 kg. (673 lb.).
Weight loaded 890 kg. (1,958 lb.).
Wing loading 65.9 kg./m.² (13.51 lb./sq. ft.).
Power loading 6.13 kg./h.p. (13.48 lb./h.p.).

PERFORMANCE.—
Max. speed 255 km.h. (158 m.p.h.).
Cruising speed 230 km.h. (143 m.p.h.).
Min. speed 77 km.h. (47.8 m.p.h.).
Ceiling 5,400 m. (17,710 ft.).
Normal range 800 km. (500 miles).

THE NARDI FN-333-S.

The FN-333-S is the production development of the previously-described FN-333. It is powered by a 225 h.p. Continental engine, has accommodation for four persons and is fitted with a novel form of wing-folding.

The wing of the FN-333-S is in five sections, consisting of centre-section and four outer sections, two each side, the inboard sections being hinged to fold upward and the outboard sections downward. The wing folding and unfolding, which is controlled from the cockpit by a system of hydraulic jacks, is automatically synchronised to ensure that, when the aircraft is afloat, the wing-tip floats are in constant contact with the water so as to maintain lateral stability. There is an independent control for normal wing-tip float retraction and lowering.

DIMENSIONS.—
Same as for FN-333 plus.
Overall width folded 3.58 m. (11 ft. 9 in.)

WEIGHTS AND LOADINGS.—
Weight empty 670 kg. (1,474 lb.).
Disposable load 306 kg. (673 lb.).
Weight loaded 976 kg. (2,147 lb.).
Wing loading 72.5 kg./m.² (14.86 lb./sq. ft.).
Power loading 4.35 kg./h.p. (9.57 lb./h.p.).

PERFORMANCE.—
Max. speed 290 km.h. (180 m.p.h.).
Cruising speed 260 km.h. (161 m.p.h.).
Min. speed 82 km.h. (51 m.p.h.).
Ceiling 7,500 m. (24,600 ft.).
Normal range 650 km. (405 miles).

PIAGGIO

PIAGGIO & C., SOCIETA' PER AZIONI.

HEAD OFFICE: VIA ANTONIO CECCHI 6, GENOA.

BRANCH OFFICES: ROME AND MILAN.

WORKS: FINALE-LIGURE, PONTEDERA, PISA AND GENOA-SESTRI.

Managing Directors: Ing. Armando Piaggio and Dr. Enrico Piaggio.

Technical Directors: Ing. Filippo Schiaffino (Railway Division), Ing. Corradino D'Ascanio (Automotive and Helicopter Division) and Ing. Giovanni P. Casiraghi (Aircraft Division).

This famous engineering firm began the construction of aeroplanes in its Genoa-Sestri plant in 1916, and later in the Finale-Ligure works. In 1938 Plant No. 2 at Pontedera was built for the construction of large multi-engined all-metal aircraft. At the Finale-Ligure plant the Piaggio company operates the first (1930) privately-owned wind tunnel and the only privately-owned water tank for seaplane model testing in Italy.

Since the war Piaggio has developed the P.136 twin-engined amphibian flying-boat, fourteen of which have been supplied to the Italian Air Force for training and coastal reconnaissance; and the P.148 two-seat primary trainer, which has been adopted as a standard type by the Italian Air Force and is now in series production.

The P.150 two-seat basic trainer, which was under development in 1951-52, made its first flight in October, 1952, and the P.149 four-seat cabin monoplane derived from the P.148, of which it uses many structural parts, flew in July, 1953.

Under development in 1953 were the P.146 twin-engined civil transport powered by Armstrong Siddeley Double-Mamba turboprop engines, and the P.138, a large twin-engined amphibian for air/sea-rescue work, powered by either Pratt & Whitney R-2000 or Wright R-1820 engines.

Piaggio is also interested in the development of radio-controlled target aircraft and of a transonic interceptor fighter.

In 1953 Piaggio began the production of Lycoming O-435 and GO-435 engines under a licence agreement with the Avco Manufacturing Corporation.

At its Pontedera works Piaggio has resumed limited production of airscrews and pursues the experimental development of helicopters.

THE PIAGGIO P.150.

TYPE.—Two-seat Basic Trainer.

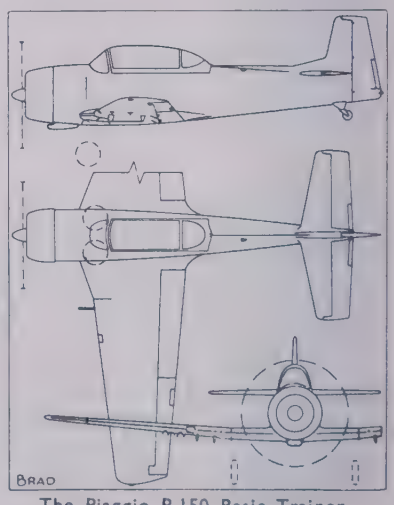
WINGS.—Low-wing cantilever monoplane. Wing section derived from NACA 230 and NACA 4412. Aspect ratio 6.6. Dihedral 5°. Incidence 2°. Chord at root 2.75 m. (7 ft. 0 in.), at tip 1.25 m. (4 ft. 1 in.). Single-spar box structure of riveted aluminium-alloy with smooth skin covering. Slotted flaps and ailerons of similar construction to wings. Total area of flaps 3.32 m.² (35.74 sq. ft.). Total aileron area 2.03 m.² (21.85 sq. ft.). Gross wing area 25.20 m.² (271.25 sq. ft.).

FUSELAGE.—Oval section monocoque of riveted aluminium-alloy.

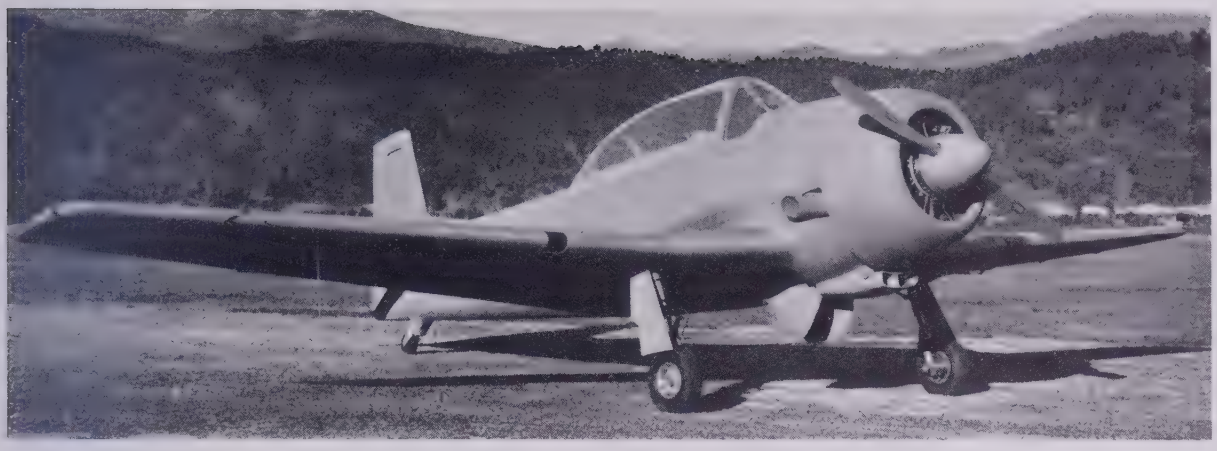
TAIL UNIT.—Cantilever monoplane type. Of similar construction to wings. Areas: fin 1.15 m.² (12.38 sq. ft.), rudder 1.20 m.² (12.92 sq. ft.), tailplane 2.50 m.² (26.91 sq. ft.), elevators (total) 1.85 m.² (19.91 sq. ft.). Tailplane span 4.35 m. (14 ft. 3 in.).

LANDING GEAR.—Retractable main wheels and non-retractable steerable tail-wheel. Hydraulic retraction. Oleo-pneumatic shock-absorbers. Hydraulic wheel brakes, with parking feature. Track 3.21 m. (10 ft. 6¼ in.). Wheelbase 6.45 m. (21 ft. 2 in.).

POWER PLANT.—One Pratt & Whitney Wasp R-1340-S3H1 nine-cylinder radial air-cooled engine, normally rated at 550 h.p. at 1,525 m. (5,000 ft.) and with 600 h.p. available for take-off. Hamilton Standard two-blade constant-speed airscrew. Four fuel tanks in centre-section, two on each side of fuselage. Total fuel capacity 620 litres (136.4 Imp. gallons = 164 U.S. gallons).



The Piaggio P.150 Basic Trainer.



The Piaggio P.150 Two-seat Basic Trainer (550 h.p. Pratt & Whitney R-1340 engine).

Oil capacity 55 litres (12.1 Imp. gallons= 14.5 U.S. gallons).

ACCOMMODATION.—Crew of two in tandem seats with complete dual controls under sliding bubble canopy. Full blind-flying and navigational training equipment. Radio. Provision for camera.

ARMAMENT.—Provision for installing one 7 mm. machine-gun in port wing, gun-sight in front cockpit, plus racks under wings for bombs and rockets.

DIMENSIONS.—
Span 12.90 m. (42 ft. 4 in.).
Length 9.25 m. (30 ft. 4 in.).
Height 2.80 m. (9 ft. 2 in.).

WEIGHTS AND LOADINGS.—
Weight empty 1,940 kg. (4,277 lb.).
Disposable load 600 kg. (1,323 lb.).
Weight loaded 2,540 kg. (5,600 lb.).
Wing loading 101 kg./m.² (20.7 lb./sq. ft.).
Power loading 4.15 kg./h.p. (9.34 lb./h.p.).

PERFORMANCE.—
Max. speed 350 km.h. (218 m.p.h.) at 1,830 m. (6,000 ft.).
Cruising speed 315 km.h. (196 m.p.h.) at 2,000 m. (6.560 ft.).
Stalling speed at S/L. 103 km.h. (64 m.p.h.).
Climb to 2,000 m. (6,560 ft.) 4 min. 30 sec.
Climb to 4,000 m. (13,120 ft.) 11 min. 8 sec.
Climb to 6,000 m. (19,680 ft.) 24 min.
Service ceiling 7,300 m. (23,950 ft.).
Range (including allowance for starting, warm-up, take-off and climb, plus half-hour reserve) 1,400 km. (870 miles).
Duration (full tanks) 4.5 hours.
Take-off run (no wind) 180 m. (590 ft.).
Landing run (no wind) 200 m. (656 ft.).

THE PIAGGIO P.149.

TYPE.—Four-seat Cabin monoplane.

WINGS.—Same as for P.148.

FUSELAGE.—Oval section all-metal monocoque of similar construction to P.148.

TAIL UNIT.—Same as for P.148.

LANDING GEAR.—Retractable nose-wheel type. Electric retraction, with emergency manual operation. Oleo-pneumatic shock-absorbers. Hydraulic wheel brakes. Track 3.15 m. (10 ft. 4 in.). Wheelbase 2.03 m. (6 ft. 8 in.).

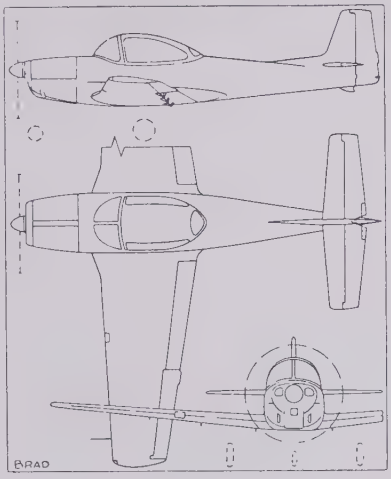
POWER PLANT.—One 260 h.p. Lycoming GO-435-C2 six-cylinder horizontally-opposed geared air-cooled engine. Piaggio P.1031 three-blade constant-speed airscrew. Three fuel tanks in wings. Total fuel capacity 260 litres (57.2 Imp. gallons= 68.7 U.S. gallons). Oil capacity 11.3 litres (2.5 Imp. gallons= 3.0 U.S. gallons).

ACCOMMODATION.—Enclosed accommodation for four in two pairs, the front pair with dual controls. Canopy slides backward for access. Large baggage compartment behind rear seats. Complete blind-flying and navigation instrumentation, including radio and D/F.

DIMENSIONS.—
Span 11.12 m. (36 ft. 6 in.).
Length 8.52 m. (27 ft. 11 in.).
Height 2.85 m. (9 ft. 4 in.).

WEIGHTS AND LOADINGS.—
Weight empty 994 kg. (2,190 lb.).
Disposable load 415 kg. (915 lb.).
Weight loaded 1,409 kg. (3,105 lb.).
Wing loading 74.9 kg./m.² (15.3 lb./sq. ft.).
Power loading 5.42 kg./h.p. (11.95 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 296 km.h. (184 m.p.h.).
Max. speed at 2,000 m. (6,560 ft.) 291 km.h. (181 m.p.h.).
Cruising speed at 1,000 m. (3,280 ft.) at 65% METO power 262 km.h. (163 m.p.h.).
Stalling speed at S/L. (with flaps) 85 km.h. (52.8 m.p.h.).
Initial rate of climb 390 m./min. (1,280 ft./min.).
Service ceiling 5,850 m. (19,200 ft.).
Range (including allowance for starting, warm-up, take-off and climb, plus ½ hour reserve) at 1,000 m. (3,280 ft.) and with full tanks 1,200 km. (746 miles).
Take-off run (no wind) to clear 15 m. (50 ft.) 222 m. (730 ft.).
Landing run (no wind) from 15 m. (50 ft.) 220 m. (720 ft.).



The Piaggio P.149 Four-seat Tourer.

THE PIAGGIO P.148.

TYPE. — Three-seat Primary Two-seat Aerobatic Trainer.

WINGS.—Cantilever low-wing monoplane. Wing section derived from NACA 230 and 4412. Aspect ratio 6.6. Taper ratio 2 :1. Dihedral 6°. All-metal aluminium-alloy riveted single-spar structure with smooth skin covering. All-metal slotted ailerons and flaps. Total flap area 2.18 m.² (23.6 sq. ft.). Total aileron area 1.52 m.² (16.4 sq. ft.). Gross wing area 18.81 m.² (203 sq. ft.).

FUSELAGE.—Circular section structure. Aluminium-alloy stressed skin monocoque.

TAIL UNIT.—Cantilever monoplane type. Aluminium-alloy riveted structure. Fin area 0.66 m.² (7.1 sq. ft.). Rudder area 0.84 m.² (9 sq. ft.). Tailplane area 2.02 m.² (21.7 sq. ft.). Total elevator area 1.52 m.² (16.4 sq. ft.).

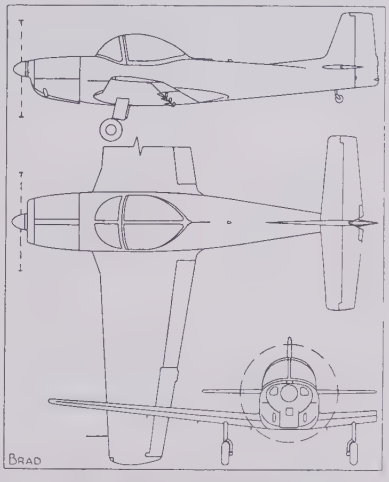
LANDING GEAR.—Non-retractable tail-wheel type. Oleo-pneumatic shock absorbers. Hydraulically operated wheel-brakes. Steerable tail-wheel. Track 2.90 m. (9 ft. 6 in.). Wheelbase 5.40 m. (17 ft. 9 in.).

POWER PLANT.—One 190 h.p. Lycoming O-435-A six-cylinder horizontally-opposed air-cooled engine driving a Piaggio P.1031 two-blade metal constant-speed airscrew. Two fuel tanks in wings, one on each side of fuselage, with total capacity of 169 litres (37 Imp. gallons).

ACCOMMODATION.—Two seats side-by-side with complete dual controls, and optional third seat aft, all enclosed by transparent bubble canopy. Rear part of canopy slides backwards for access and may be released in flight for emergency exit. Reinforced front windshield frame protects crew in event of nose-over landing.

DIMENSIONS.—
Span 11.12 m. (36 ft. 6 in.).
Length overall 8.44 m. (27 ft. 8 in.).
Height overall 2.40 m. (7 ft. 10½ in.).

WEIGHTS AND LOADINGS.—
Weight empty 876 kg. (1,931 lb.).
Disposable load (two-seater) 324 kg. (714 lb.).



The Piaggio P.148 Trainer.



The Piaggio P.148 Trainer (190 h.p. Lycoming engine).

Disposable load (three-seater) 404 kg. (891 lb.).
Gross weight (two-seater) 1,200 kg. (2,645 lb.).
Gross weight (three-seater) 1,280 kg. (2,822 lb.).
Wing loading (two seater) 63.8 kg./m.² (13.1 lb./sq. ft.).
Wing loading (three-seater) 68.0 kg./m.² (13.9 lb./sq. ft.).
Power loading (two-seater) 6.32 kg./h.p. (13.9 lb./h.p.).
Power loading (three-seater) 6.74 kg./h.p. (14.9 lb./h.p.).

PERFORMANCE (two-seater aerobatic).
Max. speed at sea level 234 km.h. (145.4 m.p.h.).
Max. speed at 2,000 m. (6,560 ft.) 223 km.h. (138.6 m.p.h.).
Max. speed at 4,000 m. (13,120 ft.) 200 km.h. (124.3 m.p.h.).
Cruising speed at 900 m. (2,953 ft.) 204 km.h. (126.8 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 3 min. 40 sec.
Climb to 2,000 m. (6,560 ft.) 8 min. 10 sec.
Climb to 3,000 m. (9,840 ft.) 15 min. 40 sec.
Climb to 4,000 m. (13,120 ft.) 26 min. 40 sec.
Service ceiling 5,000 m. (16,400 ft.).
Take-off run (no wind) 135 m. (443 ft.).
Landing run 150 m. (492 ft.).
Landing speed 80 km.h. (49.7 m.p.h.).
Duration (full tanks) 4.5 hours.
Range (including starting, warming up, take-off and climb) 923 km. (573 miles).

PERFORMANCE (three-seater).—
Max. speed at sea level 232 km.h. (144.2 m.p.h.).
Max. speed at 2,000 m. (6,560 ft.) 220 km.h. (137.3 m.p.h.).
Max. speed at 4,000 m. (13,120 ft.) 198 km.h. (123.0 m.p.h.).
Cruising speed at 900 m. (2,953 ft.) 201 km.h. (124.9 m.p.h.).
Landing speed 83 km.h. (51.6 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 4 min. 30 sec.
Climb to 2,000 m. (6,560 ft.) 11 min. 0 sec.
Climb to 3,000 m. (9,840 ft.) 19 min. 0 sec.
Service ceiling 4,400 m. (14,436 ft.).
Duration (full tanks) 4 hours.
Range (including allowance for starting, warming up, take-off and climb) 800 km. (497 miles).
Take-off run (no wind) 194 m. (636 ft.).
Landing run 180 m. (591 ft.).



The Piaggio P.136-L Amphibian (two 260 h.p. Lycoming GO-435 engines).

THE PIAGGIO P.136-L.

TYPE.—Twin-engined Five-seat Amphibian Flying-boat.

WINGS.—High-wing gull-shaped cantilever monoplane. NACA 230 wing section. Aspect ratio 7.4. Dihedral —21° 30′ inner gull portion, +2° 5′ outer wing. Chord 2.40 m. (7 ft. 10½ in.) root, 1.15 m. (3 ft. 9½ in.) tip. All-metal aluminium-alloy riveted structure. Single-spar box type, smooth skin covering. All-metal slotted trailing-edge flaps. Metal-framed fabric-covered slotted ailerons. Total flap area 2.38 m.² (25.6 sq. ft.). Total aileron area 1.95 m.² (21 sq. ft.). Gross wing area 24.9 m.² (268 sq. ft.).

HULL.—Two-step type. All-metal plated aluminium-alloy riveted semi-monocoque structure. Side floats attached to wing by single streamline strut.

TAIL UNIT.—Cantilever monoplane type. All-metal plated aluminium-alloy riveted structure. Tailplane and fin covered with smooth metal skin. Elevators and rudder fabric-covered. Trimming tabs in elevators and rudder. Fin area 1.81 m.² (19.5 sq. ft.), rudder area 0.77 m.² (8.3 sq. ft.), total elevator area 2.55 m.² (27.4 sq. ft.), tailplane area 2.82 m.² (30.5 sq. ft.).

LANDING GEAR.—Retractable type. Hydraulically operated. Oleo-pneumatic shock absorbers. Hydraulic wheel brakes. Track 2.54 m. (8 ft. 4 in.). Wheelbase 5.72 m. (18 ft. 9 in.).

POWER PLANT.—Two Lycoming GO-435-C2 six-cylinder horizontally-opposed air-cooled engines installed as pushers and driving Piaggio P.1030 three-blade metal constant-speed propellers. One fuel tank in hull, capacity 730 litres (161 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating two side-by-side in front and three on large seat aft. Dual controls. Two side doors. Right-hand panel of windshield fully openable for mooring, etc.

DIMENSIONS.—
Span 13.53 m. (44 ft. 4.7 in.).
Length overall 10.80 m. (35 ft. 5 in.).
Height overall 3.50 m. (11 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 1,750 kg. (3,858 lb.).
Disposable load 850 kg. (1.874 lb.).
Weight loaded 2,600 kg. (5,732 lb.).
Wing loading 104.4 kg./m.² (21.4 lb./sq. ft.).
Power loading, take-off 5.0 kg./h.p. (11.0 lb./h.p.).

PERFORMANCE (at 2,500 kg. = 5,500 lb. gross weight).
Max. speed at sea level 279 km.h. (173.4 m.p.h.).
Cruising speed (70% rated power) 247 km.h. (153.5 m.p.h.) at 1,500 m. (5,000 ft.).
Stalling speed with flaps 118 km.h. (73.3 m.p.h.).
Service ceiling 5,000 m. (16,400 ft.).
Range with 590 kg. (1,300 lb.) payload 560 km. (350 miles).
Range with 450 kg. (1,000 lb.) payload 1,015 km. (630 miles).

SIAI-MARCHETTI

SOCIETÀ PER AZIONI SIAI-MARCHETTI.

HEAD OFFICE AND WORKS: SESTO CALENDE (VARESE).

The SIAI-Marchetti company, formerly known as Savoia-Marchetti, has produced a wide range of military and civil aircraft covering both landplanes and flying-boats, and before the war devoted much attention to the development of the three-engined low-wing monoplane. Aeroplanes in this category included the SM.79 and SM.82 widely used by the *Regia Aeronautica* and the SM.75, SM.81 and SM.84, all of which have been described in previous issues of this work.

During the War the Company produced a number of experimental military aircraft, including the SM.91, SM.92 and SM.93.

After the War the Company built the SM.95 four-engined commercial monoplane, and the SM.102 twin-engined short-range passenger monoplane. Both these aircraft have been fully described and illustrated in previous editions of "All the World's Aircraft."

After suffering heavy financial losses owing to lack of government orders, SIAI-Marchetti went into liquidation in September, 1951, but by the beginning of 1953 the company had practically overcome its financial difficulties.

In the aircraft field the company is overhauling and repairing various types of aircraft for the Italian Air Force and is building a small number of SM. 102 monoplanes. It has also started the construction of two new prototypes, the SM. 122 turboprop and SM. 132 turbojet aircraft, of which no information was available at the time of writing.

Other non-aeronautical branches of the firm are working to full capacity.

JAPAN

FUJI

FUJI KOGYO KABUSHIKI KAISHA.

HEAD OFFICE: No. 1 I-CHOME, KYOBASHI, CHUO-KU, TOKYO.

This is a part of the former Nakajima Aircraft Manufacturing Co., Ltd. It has concluded an agreement with Doman Helicopters, Inc. of Danbury, Connecticut, U.S.A., for the manufacture under licence of Doman helicopters in Japan. At the outset a number of American-built helicopters will be supplied to Fuji, the delivery of the first helicopter being expected late in 1953.

Fuji Kogyo is conducting merger negotiations through the medium of the Japan Industrial Bank, with the three other post-war subsidiaries of the pre-war Nakajima company—Omiya Fuji, Fuji Automobile Industry Company and Tokyo Fuji Saugyo—which it is hoped, will enable a re-constituted organization, representing a come-back of the pre-war Nakajima company, to undertake the complete manufacture of aircraft.

KAWASAKI GIFU

KAWASAKI GIFU SEISAKUJO KABUSHIKI KAISHA.

HEAD OFFICE: MIKAKINO, SOBARAMACHI, INABA-GUN, GIFU.

This is the reconstituted aircraft branch of the former Kawasaki Kokuki K.K. Seventy per cent. of the wartime Kawasaki factory at Kagamigahara, on the outskirts of Gifu City, was destroyed by fire, but the new company is using the remainder of the factory while reconstruction is under way.

Kawasaki Gifu is overhauling and repairing aircraft for the U.S. Far East Air Force, and it is also undertaking the design of light aircraft.

KAWASAKI KIKAI

KAWASAKI KIKAI KOGYO KABUSHIKI KAISHA.

HEAD OFFICE: No. 1-2, WADAYAMA-TORI, HYOGO-KU, KOBE.

This company has taken over the former aero-engine division of the Kawasaki Kokuki K.K., whose works at Nishi-Akashi were completely demolished during the war. The greater part of the machinery and equipment was evacuated to the suburbs and escaped destruction.

Kawasaki Kikai has acquired a licence from the Bell Aircraft Corporation to build the Model 47 helicopter, and the company will receive special financial assistance from the Japan Development Bank in 1953 to enable it to instal the necessary equipment and machinery for helicopter production.

The company will also undertake the manufacture of aero-engines, for which it already possesses the necessary mechanical equipment for the building of power-units up to 400-500 h.p.

It is the intention of Kawasaki Kikai eventually to manufacture all engines likely to be needed by both the Kawasaki Kikai and Kawasaki Gifu companies.

MITSUBISHI

SHIN MITSUBISHI JYU KOGYO KABUSHIKI KAISHA (New Mitsubishi Heavy Industries Co., Ltd.).

HEAD OFFICE: No. 1-7, WADAMIYA-TORI, HYOGO-KU, KOBE.

About 90 per cent. of the Nagoya works of the Mitsubishi company was destroyed by air bombing during the war, but the greater part of the machinery and equipment was evacuated and is still intact.

A new plant has been built alongside the Kumaki airfield, which is being used by the U.S.A.F. and Japan Air Lines, and it is expected that the company will undertake the overhaul and repair of U.S.A.F. aircraft. Mitsubishi is also overhauling engines for Japan Air Lines.

OKAMURA

OKAMURA SEISAKUJO KABUSHIKI KAISHA (Okamura Manufacturing Co., Ltd.).

HEAD OFFICE: No. 1515, OKAMURA-CHO, ISOGO-KU, YOKOHAMA.

Managing Director: K. Yoshihara.

Chief Engineer: Dr. M. Yamana.

This company was one of the branch works of the Nihon Aircraft Works which was building training aircraft for the Japanese Navy before the end of the war.

In 1952 Okamura began light aircraft manufacture. Its first product, the N-52 two-seat light monoplane, which was built to the original designs of Professor H. Kimura of Nihon University, made its first flight on April 7, 1953.

Okamura is now building a two-seat soaring glider for the Tokyo University.



The Okamura N-52 (65 h.p. Continental A65 engine).

THE OKAMURA N-52.

TYPE.—Two-seat light monoplane.

WINGS.—Low-wing cantilever monoplane. Japanese F5 Mod's 3015 wing section at root, 3009 at tips. Incidence 3°. Dihedral 5°. Chord 1.80 m. (5 ft. 11 in.) at root, 0.9 m. (2 ft. 11 in.) at tip. One piece wing attached to fuselage by four bolts. One main and one auxiliary spars, girder wooden ribs, plywood leading-edge and overall fabric covering. Frise type ailerons. No flaps. Total aileron area 0.99 m.² (10.7 sq. ft.). Gross wing area 12.0 m.² (129 sq. ft.).

FUSELAGE.—Welded steel tube structure covered with fabric over wood formers. Maximum width 1.10 m. (3 ft. 7 in.).

TAIL UNIT.—Braced monoplane type. Welded steel tube frames covered with fabric. One-piece tailplane strut-braced below and wire-braced above. One-piece elevator with trim-tab. Total horizontal area 2.2 m.² (23.7 sq. ft.). Total vertical area 1.0 m.² (10.8 sq. ft.). Span of tail 3.0 m. (9 ft. 10 in.).

LANDING GEAR.—Fixed tail-wheel type. Main wheels on half axles with rubber cord springing. Leaf-sprung tail-wheel. Track 2.0 m. (6 ft. 5¾ in.).

POWER PLANT.—One 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine. Two-blade wood airscrew, 1.76 m. (5 ft. 9 in.) diameter. Fuel tank (50 litres = 11 Imp. gal.) in fuselage.

ACCOMMODATION.—Open cockpit seating two side-by-side with dual controls.

DIMENSIONS.—
Span 8.60 m. (28 ft. 2½ in.).
Length 6.00 m. (19 ft. 8 in.).
Height 2.60 m. (8 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 364 kg. (803 lb.).
Disposable load 193 kg. (425 lb.).
Weight loaded 557 kg. (1,228 lb.).
Wing loading 46.4 kg./m.² (9.5 lb./sq. ft.).
Power loading 8.6 kg./h.p. (18.9 lb./h.p.).

PERFORMANCE.—
Max. speed 165 km.h. (103 m.p.h.).
Cruising speed 150 km.h. (93 m.p.h.).
Stalling speed 83 km.h. (51 m.p.h.).
Initial rate of climb 120 m./min. (394 ft./min.).
Service ceiling 2,800 m. (9,200 ft.).
Range in still air 450 km. (280 miles).

SHOWA

SHOWA HIKOKI KABUSAIKI KAISHA (Showa Aircraft Works Co., Ltd.).

HEAD OFFICE: No. 1, 2-CHOME, MUROMACHI, NIHOMBASHI, CHUO-KU, TOKYO.

Showa was the first Japanese aircraft manufacturing company to resume post-war operations when it undertook the overhaul and repair of aircraft of the Far East Air Force under contract with the U.S. occupation authorities. Owing to the company's limited capacity—and lack of facilities—it is unlikely that it will engage in the production of complete aircraft.

TACHIKAWA

SHIN TACHIKAWA KOKUKI KABUSHIKI KAISHA (New Tachikawa Aircraft Co., Ltd.).

HEAD OFFICE: No. 100 1-CHOME, TAKAMATSU-CHO, TACHIKAWA-SHI, TOKYO.

FACTORIES: TACHIKAWA AND SUNAGAWA.

President: Yoshio Kawasaki.

Director in charge of Engineering: Ryokichi Endo.

The New Tachikawa Aircraft Company was established on November 15, 1949, as the second reconstructed company of the former Tachikawa Aircraft Co., Ltd. with the aid of the Enterprise Reconstruction and Reorganisation Law.

As all the factory area of the former Tachikawa company has been in use by the U.S. Air Force since September 4, 1945, the company has built a new factory at Sumagawa, outside the former factory area.

Until the Air Law permitting the manufacture of aircraft was published on July 15, 1952, the company made various industrial articles, mainly of sheet metal work, and some aircraft parts under contract with the U.S. Air Force authorities.

As soon as the Air Law was passed the

company began the design of its first aeroplane, the R-52. The R-52 was completed in September, 1952 and was the first aircraft built entirely of Japanese materials and powered by a Japanese engine to be completed since the war. After the completion of its trials this aircraft was presented to the Yomiuri Press for student instruction.

At the time of writing a revised version of the R-52 was being built. This aircraft, the R-52B, will be fitted with a Cirrus Major engine in place of the Jimpu Type 2 radial. It was expected that the R-52B would be completed in June, 1953.

In the future the new Tachikawa company will devote its efforts to the design and manufacture of light aircraft, trainers and small passenger-carrying aircraft.



The Tachihi R-52 Trainer (130 h.p. Jimpu Type 2 engine).

THE TACHIHI R-52.

TYPE.—Two-seat Trainer.

WINGS.—High-wing strut-braced monoplane. NACA 23012 wing section. Aspect ratio 6.62. Dihedral nil. Two Japanese cypress spars, pressed duralumin ribs and fabric covering. No flaps on slots. Gross wing area 17.3 m.² (186 sq. ft.).

FUSELAGE.—Welded steel tube structure covered with fabric.

TAIL UNIT.—Strut-braced monoplane type. Pressed duralumin construction with fabric covering. Areas: fin 0.3 m.² (3.2 sq. ft.), rudder 1.2 m.² (12.9 sq. ft.), horizontal tail area 2.5 m.² (26.9 sq. ft.).

LANDING GEAR.—Fixed tail-wheel type. Oil spring shock-absorber struts. Spring steel tail-skid.

POWER PLANT.—One 130 h.p. Jimpu Type 2 seven-cylinder radial air-cooled engine. Two-blade fixed-pitch wood airscrew 2.45 m. (5 ft. 4½ in.) diameter. Fuel tank (160 litres = 35.2 Imp. gallons) in centre-section of wing.

ACCOMMODATION.—Tandem open cockpit with dual controls.

DIMENSIONS.—
Span 10.7 m. (35 ft.).
Length 7.4 m. (24 ft. 3 in.).
Height 2.8 m. (9 ft. 2 in.).

WEIGHTS.—
Weight empty 682 kg. (1,500 lb.).
Disposable load 275 kg. (605 lb.).
Weight loaded 957 kg. (2,105 lb.).

PERFORMANCE.—
Max. speed 200 km.h. (124 m.p.h.).
Cruising speed 150 km.h. (93 m.p.h.).
Stalling speed 89 km.h. (55.2 m.p.h.).
Initial rate of climb 220 m./min. (722 ft./min.).
Absolute ceiling 5,000 m. (16,400 ft.).
Cruising range 500 km. (310 miles).

TOYO

TOYO KOKU KABUSHIKI KAISHA (Toyo Aircraft Manufacturing Company Ltd.).

HEAD OFFICE: NIKKATSU INTERNATIONAL BUILDING, YURAKU-CHO, CHIYODA-KU, TOKYO.

PARTS SHOP: 5021, TOFSUKA-CHO, TOFSUKA-KU, YOKOHAMA.

ASSEMBLY SHOP AND AIRSTRIP: OHARA FUJISAWA, KANAGAWA PREFECTURE.

President: Shigemi Yokoo.

Vice-President and Managing Director: Shingo Ishikawa.

Director of Technical Services and Chief Engineer: Yoshio Hashiguchi.

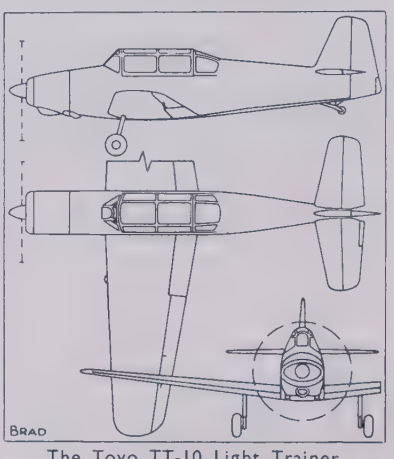
The Toyo Aircraft Manufacturing Company was formed on June 10, 1952, by Shigemi Yokoo, a former Minister of International Trade and Industry; Shingo Ishikawa, a former admiral of the Imperial Japanese Navy; and Yoshio Hashiguchi, who was formerly managing director and chief engineer of the Kawasaki Aircraft Company.

The company's first aircraft, the Type TT-10, made its first flight on December 30, 1952. The first production TT-10 flew on February 11, 1953.

Toyo holds the manufacturing and sales licences for the FD-25 and FD-25A from the Fletcher Aviation Corporation of Pasadena, California, U.S.A. These aircraft are now in production. A description of the FD-25 will be found under "Fletcher" (U.S.A.).

The Fletcher Aviation Corporation is a stock participant in Toyo, as is the Air Carrier Service Corporation of Washington, D.C. The Air Carrier Service Corporation are export representatives for Toyo and also act as purchasing and technical agents for Toyo in the United States.

In addition to building complete aircraft Toyo is also engaged in general aircraft overhaul and maintenance work.



The Toyo TT-10 Light Trainer.



The Toyo TT-10 Light Trainer (140 h.p. Lycoming O-290 engine).

THE TOYO TT-10.

TYPE.—Two-seat Light Trainer.

WINGS.—Low-wing cantilever monoplane. Wing sections NACA 1415 at root, NACA 2410 (modified) at tip. Aspect ratio 6. Chord 1.82 m. (5 ft. 11 in.) at root, 1.37 m. (4 ft. 6 in.) mean. Dihedral 6°. Incidence 2°30′ at root, 1°30′ at tip. Two-spar all-wood structure with plywood skin and final covering of fabric. Flaps and ailerons have wood framework and fabric covering. Total area of flaps 0.78 m.² (8.4 sq. ft.). Total aileron area 1.11 m.² (12 sq. ft.). Gross wing area 12 m.² (128 sq. ft.).

FUSELAGE.—Welded chrome-molybdenum steel tube framework with fabric covering.

TAIL UNIT.—Cantilever monoplane type. All wood structure with fabric covering or all-metal construction. Areas: fin 0.9 m.² (9.7 sq. ft.), rudder 0.4 m.² (4.35 sq. ft.), tailplane 1.09 m.² (11.8 sq. ft.), elevators 0.9 m.² (9.7 sq. ft.). Tailplane span 2.9 m. (9 ft. 9 in.).

LANDING GEAR.—Fixed tail-wheel type. Oleo-pneumatic shock absorbers. Goodrich wheels and toe-operated hydraulic brakes. Tail-wheel has coil-spring shock-absorber. Track-wheel has coil-spring shock-absorber. Track 2.48 m. (8 ft. 2 in.).

POWER PLANT.—One 140 h.p. Lycoming O-290-D2 four-cylinder horizontally-opposed air-cooled engine. Sensenich CS3FM4/C374 two-blade fixed-pitch airscrew. Fuel tank in fuselage. Total fuel capacity 23.8 gallons (90 litres).

ACCOMMODATION.—Tandem seats under continuous canopy with sliding sections over both seats. Dual controls.

DIMENSIONS.—
Span 8.60 m. (28 ft. 2 in.).
Length 7.15 m. (23 ft. 5 in.).
Height (tail down) 2.10 m. (6 ft. 10 in.).

WEIGHTS AND LOADINGS.
Weight empty 568 kg. (1,240 lb.).
Weight loaded 800 kg. (1,760 lb.).
Wing loading 67 kg./m.² (13.9 lb./sq. ft.).
Power loading 5.94 kg./h.p. (13.1 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 235 km.h. (147 m.p.h.).
Cruising speed 190 km.h. (119 m.p.h.).
Stalling speed (without flaps) 92 km.h. 57.5 m.p.h.).
Stalling speed (30° flap) 80 km.h. (50 m.p.h.).
Initial rate of climb 228 m./min. (750 ft./min.).
Service ceiling 4,300 m. (14,100 ft.).
Absolute ceiling 5,000 m. (16,400 ft.).
Cruising range 760 km. (470 miles).
Take-off distance to clear 15.25 m. (50 ft.) 290 m. (950 ft.).
Landing distance from 15.25 m. (50 ft.) 300 m. (985 ft.).

NETHERLANDS

DE SCHELDE

N. V. KONINKLIJKE MAATSCAPPIJ "DE SCHELDE."

HEAD OFFICE: VLISSENGEN (FLUSHING).

AIRCRAFT WORKS: DORDRECHT, NEAR ROTTERDAM.

The aircraft division of the well-known De Schelde shipbuilding concern was formed in 1935. It took over the design staff of Pander & Zonen when that company closed down its aviation department at the end of 1934.

Before the war De Schelde built a number of aircraft of original design but its aviation activities came to an end in 1940.

After the war the company re-opened its Dordrecht works and undertook the manufacture in light metal of a wide variety of products, including omnibus bodies and patrol boats. It also built a small series of primary gliders with light metal frames for the Royal Dutch Aero Club and undertook the conversion of Dakota transports and the overhaul and repair of aircraft for the Government Flying School.

In 1951 De Schelde was licensed by the Swedish Saab company to handle the entire production of the Saab-91B Safir three-seat all-metal light civil and military trainer and tourer, a considerable number of which have been ordered by the Royal Swedish Air Force. Series production of the Safir is being undertaken in a recently-completed factory extension which increases the company's floor space to some 15,000 m.² (161,400 sq. ft.). Details of the Safir will be found under SAAB (Sweden).

FOKKER

THE N.V. KONINKLIJKE NEDERLANDSCHE VLIEGTUIGENFABRIEK FOKKER (Royal Netherlands Aircraft Factories Fokker).

HEAD OFFICE AND MAIN FACTORY: SCHIPHOL-ZUID, AMSTERDAM.

SECOND FACTORY: PAPAVERWEG 31-33, AMSTERDAM-NOORD.

The Fokker Works were founded at Amsterdam in 1919 by the late A. H. G. Fokker, the well-known aircraft designer, who died on December 23, 1939.

Up to the time of the invasion of Holland in May, 1940, the Fokker Company had produced a wide range of commercial and military aircraft of all-metal and mixed construction which found a ready sale in the World's markets.

After having rebuilt the war-damaged factory in the north of Amsterdam, a new factory was built in 1951 on the Schiphol Airport, where the main production takes place.

The current types of Fokker aircraft built or under construction are the S.11 Instructor two-seat basic trainer; the S.12, a nose-wheel version of the S.11; the S.13 Universal Trainer, a twin-engined crew trainer; the S.14 Mach.-Trainer two-seat transition jet trainer; the F.27 Friendship 28-passenger twin-turboprop airliner and its freighter version, the Freightship.

The S.11 Instructor is in service in the Netherlands, Israel and Italian Air Forces, The Italian Macchi company builds the Instructor under licence under the designation M.B. 416.

The Brazilian Government has adopted the Instructor for pilot training and it will be built in Brazil by a recently-formed Brazilian Fokker subsidiary.

The American Fairchild Engine and Airplane Corporation has acquired an option on licences to build all the above-mentioned types.

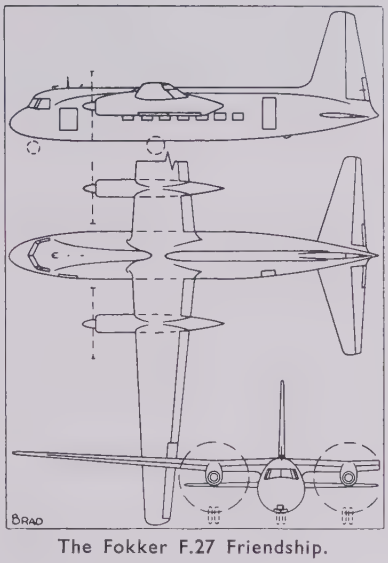
Fokker holds licences to build the Gloster Meteor 8 and the Hawker Sea Fury. Meteors are being supplied to the Netherlands and Belgian Air Forces and a series of Sea Furies has been built for the Netherlands Air Force.

Fokker is making preparations to begin production of the Hawker Hunter.

THE FOKKER F.27 FRIENDSHIP.

The F.27 has been designed as a medium-sized airliner suitable for short to medium range continental traffic. Two prototypes are being built, both to be powered with two 1,400 h.p. Rolls-Royce Dart turboprop engines. The F.27 can, however, be fitted with two Wright Cyclone 955C9HE2 radial air-cooled engines for those operators who wish to continue using conventional piston engines.

The F.27 is a high-wing cantilever monoplane with normal accommodation for 28 passengers in backward-facing seats in a pressurised cabin. For short range high-density traffic the number of seats may be increased up to a maximum of 40. The low floor level, large cargoholds and a removable front cabin wall make the F.27 well suited to those local services with many intermediate stops where quick and simple loading and adaptation to ever-changing load demands are of importance.



The Fokker F.27 Friendship.

No structural details of the F.27 have been released but the following provisional specification may be quoted.

DIMENSIONS.—
Span 29.0 m. (95 ft.).
Length 20.0 m. (65 ft. 6 in.).
Height 7.62 m. (25 ft.).
Wing area 70.0 m.² (754 sq. ft.).

WEIGHTS AND LOADINGS (Designed).—
Weight empty 9,060 kg. (19,950 lb.).
Passengers (28) and baggage 2,660 kg. (5,850 lb.).
Freight 910 kg. (2,000 lb.).
Weight loaded 14,500 kg. (31,950 lb.).
Wing loading 205.8 kg./m.² (42.4 lb./sq. ft.).

PERFORMANCE (Two Rolls-Royce Dart engines—estimated).—
Max. speed at 6,000 m. (19,680 ft.) 438 km.h. (274 m.p.h.).
Economic cruising speed at 6,000 m. (19,680 ft.) 394 km.h. (246 m.p.h.).
Service ceiling 10,200 m. (33,500 ft.).
Take-off distance to clear 15 m. (50 ft.) 1,280 m. (1,400 yds.).
Landing distance from 15 m. (50 ft.) 1,150 m. (1,256 yds.).
Stage length at cruising speed 496 km. (310 miles).
Block speed 333 km.h. (208 m.p.h.).

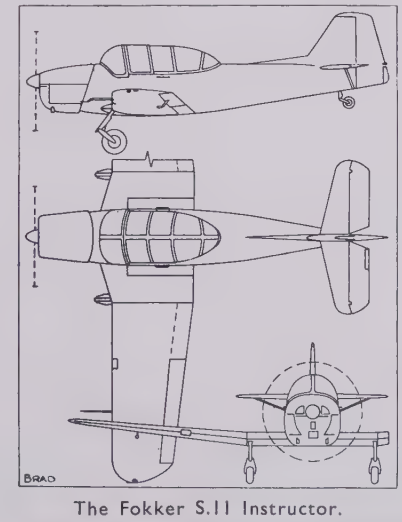
THE FOKKER F.27 FREIGHTSHIP.

A cargo version of the F.27 is envisaged. This will differ from the Friendship in having a reinforced cargo floor and large cargo entrance door. The cabin will not be pressurised.

DIMENSIONS.—
Same as for F.27 Friendship.

WEIGHTS and LOADING (Designed).—
Weight empty 8,560 kg. (18,860 lb.).
Cargo 3,840 kg. (8,450 lb.).
Weight loaded 14,500 kg. (31,950 lb.).
Wing loading 205.8 kg./m.² (42.4 lb./sq. ft.).

PERFORMANCE (Estimated).—
Max. speed at 3,000 m. (9,840 ft.) 432 km.h. (270 m.p.h.).
Economic cruising speed at 3,000 m. (9,840 ft.) 360 km.h. (225 m.p.h.).
Block speed 315 km.h. (197 m.p.h.).
Other figures as for F.27 Friendship.



The Fokker S.11 Instructor.

THE FOKKER S.11 INSTRUCTOR.

TYPE.—Two-seat Basic Trainer.

WINGS.—Cantilever low-wing monoplane. All-metal one-piece structure. Manually-operated light-metal landing flaps. Metal-framed fabric-covered ailerons. Wing area 18.5 m.² (199 sq. ft.).

FUSELAGE.—Welded steel-tube structure with fabric covering.

TAIL UNIT.—Braced monoplane type. Fin integral with fuselage. All-metal tailplane mounted half-way up fin and braced to fuselage by single strut on each side. Horn-balanced rudder and elevators have metal frames and fabric covering. Controllable elevator trim-tab; rudder trim-tab adjustable on ground.

LANDING GEAR.—Fixed two-wheel type. Main wheels each carried on Olaer levered-suspension cantilever leg. Hydraulic wheel-brakes. Steerable tail-wheel.



The Fokker S.11 Instructor (190 h.p. Lycoming O-435A engine).



The Fokker S.12 Instructor which has a tricycle landing-gear.

POWER PLANT.—One 190 h.p. Lycoming O-435A six-cylinder horizontally-opposed air-cooled engine on welded steel-tube bearer and driving two-blade fixed-pitch wooden airscrew. Alternatively an Aeromatic automatically-adjustable-pitch airscrew may be fitted. Two Goodyear Pliocel fuel tanks in wings one on each side of fuselage, with total capacity of 150 litres (34 Imp. gallons).

ACCOMMODATION.—Two seats side-by-side with dual controls. Perspex canopy slides backwards for access. Heavy arch between front and rear seats to protect occupants.

EQUIPMENT.—Full instrument equipment. Fire-extinguisher behind engine. Electrical system for instrument board and navigation instrument lighting and operation, as well as starter.

DIMENSIONS.—
Span 11.0 m. (36 ft. 1 in.).
Length 8.18 m. (26 ft. 8 in.).
Height 2.22 m. (7 ft. 5 in.).

WEIGHTS AND LOADINGS (fixed-pitch airscrew).—
Weight empty (equipped) 810 kg. (1,784 lb.).
Crew (two, with parachutes) 180 kg. (396 lb.).
Fuel and oil 110 kg. (242 lb.).
Normal weight loaded 1,100 kg. (2,426 lb.).
Wing loading (normal) 59.5 kg./m.² (12.2 lb./sq. ft.).
Power loading (normal) 5.8 kg./h.p. (12.8 lb./h.p.).

PERFORMANCE (fixed-pitch airscrew).—
Max. speed 209 km.h. (130 m.p.h.).
Cruising speed 164 km.h. (102 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 5.6 min.
Climb to 2,000 m. (6,560 ft.) 13.4 min.
Climb to 3,000 m. (9,840 ft.) 25.4 min.
Service ceiling 3,850 m. (12,600 ft.).
Absolute ceiling 4,450 m. (14,600 ft.).
Take-off run in 10 km.h. (6 m.p.h.) wind 195 m. (213 yds.).

THE FOKKER S.12 INSTRUCTOR.

The S.12 is identical to the S.11 previously described except that it is fitted with a tricycle landing-gear. In the S.12 the main landing-gear units are moved back a few inches but the basic wing structure is stressed to support the gear in either position. Similarly, the fitting of the nose wheel is provided for in the basic fuselage structure.

THE FOKKER S.13 UNIVERSAL TRAINER.

TYPE.—Twin-engined Advanced Crew Trainer.

WINGS.—Low-wing cantilever monoplane. Two-spar all-metal structure with light metal skin. Detachable wing-tips. Hydraulically-operated flaps between ailerons. Wing area 46 m.² (495 sq. ft.).

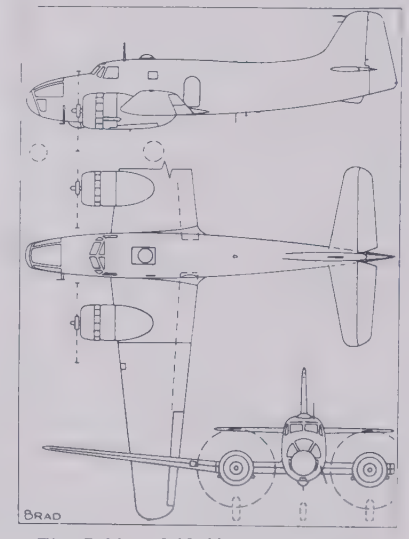
FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal framework, fin and tailplane metal-covered and rudder and elevators fabric-covered. Trim-tabs on elevator and rudder.

LANDING GEAR.—Retractable tricycle type. Hydraulic operation. May be fitted with twin all-metal floats (S.13-W).

POWER PLANT.—Two 600 h.p. Pratt & Whitney Wasp S1H1-G nine-cylinder radial air-cooled engines, each driving a two-blade Hamilton Hydromatic full-feathering airscrew. Six fuel tanks in wings. Total fuel capacity: 1,200 litres (264 Imp. gals.). Other engines of approximately 600-700 h.p. each may be installed.

ACCOMMODATION.—Bomb-aimer's position in nose. Pilot's compartment with side-by-side seating and dual controls. Starboard controls removable to give access to bomb-aimer's compartment. Crew compartment aft of pilots is arranged from front to rear as follows:—seat for radio operator, seat for navigator, seat for instructor and two tables and seats for pupils. Jettisonable entrance door, with dinghy stowage, at rear of compartment on port side. Two emergency exits in roof.



The Fokker S.13 Universal Trainer.

DIMENSIONS.
Span 19.2 m. (63 ft.).
Length 13.6 m. (44 ft. 7 in.).
Height 5.5 m. (18 ft.).

WEIGHTS AND LOADINGS.—
Weight empty with fixed equipment 4,185 kg. (9,225 lb.).
Weight loaded 5,775 kg. (12,735 lb.).
Wing loading 125 kg./m.² (25.7 lb./sq. ft.).
Power loading 4.8 kg./h.p. (10.6 lb./h.p.).

PERFORMANCE.
Max. speed at 2,440 m. (8,000 ft.) 355 km.h. (220 m.p.h.).
Cruising speed at 3,600 m. (11,800 ft.) 320 km.h. (199 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 2.7 min.
Climb to 2,000 m. (6,560 ft.) 5.7 min.
Climb to 3,000 m. (9,840 ft.) 9.2 min.
Climb to 4,000 m. (13,120 ft.) 13.5 min.
Service ceiling 6,500 m. (21,300 ft.).
Absolute ceiling 6,900 m. (22,600 ft.).
Absolute ceiling on one engine 2,600 m. (8,500 ft.).

THE FOKKER S.14 MACH-TRAINER.

TYPE.—Two-seat Jet trainer for transition, blind-flying, navigational and tactical training of fighter pilots.

WINGS.—Low-wing cantilever monoplane. All-metal monospar structure with flush-riveted stressed Alclad skin. Ailerons on outer sections with spring tabs. Pneumatically-operated split trailing-edge flaps between ailerons and fuselage. Wing area 31.8 m.² (342.1 sq. ft.).

FUSELAGE.—Circular section structure mainly of light metal construction, the engine compartment being of steel. Pneumatically-operated dive-brakes open out from sides and underside of fuselage aft of wings.

TAIL UNIT.—Cantilever monoplane type. All-metal construction. Fin integral with rear fuselage. Statically-balanced light elevators. Statically-balanced geared tabs in both elevators, trim tab in port elevator. Tailplane span 5.00 m. (16 ft. 6.4 in.).

LANDING GEAR.—Retractable tricycle type. Pneumatic retraction. Main and nose wheel units of levered-suspension type with Dowty liquid-spring shock-absorbers. Pneumatically-operated disc brakes on main wheels. Self-centering nose-wheel. Track 4.95 m. (16 ft. 3 in.). Wheelbase 4.00 m. (13 ft. 3 in.).

POWER PLANT.—One Rolls-Royce Derwent 8 or Nene 3 centrifugal-flow turbojet engine in centre-section of fuselage with nose air entry, dividing to pass on each side of cockpit, and tail jet exit. Six flexible lightweight hycatrol fuel tanks in wings, two in centre-section and two in each outer section. Total fuel capacity 1,728 litres (350 Imp. gallons).

ACCOMMODATION.—Enclosed cockpit seating instructor and pupil side-by-side with dual controls. Electrically-operated sliding and jettisonable canopy. Cockpit separated from engine compartment by steel fireproof bulkhead.

EQUIPMENT.—Complete blind-flying and navigational training equipment. Provision for armament-pack installation beneath



The Fokker S.13 Universal Trainer (two 600 h.p. Pratt & Whitney Wasp engines).



The Fokker S.14 Mach-Trainer (Rolls-Royce Derwent turbojet engine).

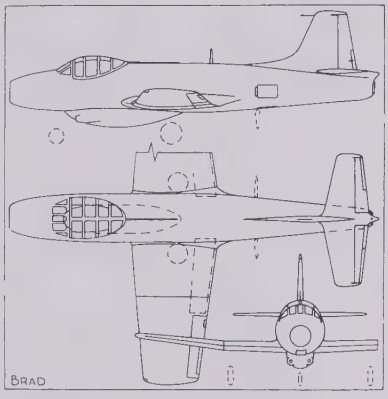
fuselage of two 20 mm. cannon and ammunition. Camera-gun. Racks for eight 3 in. rockets or eight 25-lb. practice bombs.

DIMENSIONS.—
Span 12 m. (39 ft. 5 in.).
Length 13.3 m. (43 ft. 8 in.).
Height 4.7 m. (15 ft. 4 in.).

WEIGHTS AND LOADING (Rolls-Royce Derwent 8 engine).—
Weight empty 3,765 kg. (8,304 lb.).
Crew (2) and parachutes 214 kg. (472 lb.).
Fuel and oil 1,371 kg. (3,024 lb.).
Take-off weight 5,350 kg. (11.800 lb.).
Wing loading 168 kg./m.² (34.5 lb./sq. ft.).

WEIGHTS AND LOADING (Rolls-Royce Nene 3 engine).—
Weight empty 3,970 kg. (8,745 lb.).
Crew (2) and parachutes 214 kg. (472 lb.).
Fuel and oil 1,366 kg. (3,013 lb.).
Weight loaded 5,550 kg. (12,230 lb.).
Wing loading 174.5 kg./m.² (36 lb./sq. ft.).

PERFORMANCE (Rolls-Royce Derwent 8 engine).—
Max. speed at 6,000 m. (19,680 ft.) at combat rating 715 km.h. (445 m.p.h.).
Mean cruising speed at 9,000 m. (29,520 ft.) 590 km.h. (366 m.p.h.).
Min. speed at S/L. (flaps 45°) 142 km.h. (88 m.p.h.).
Max. rate of climb at S/L. 990 m./min. (3,250 ft./min.).



The Fokker Mach-Trainer.

Climb to 3,000 m. (9,840 ft.) 3.6 min.
Climb to 6,000 m. (19,680 ft.) 8.2 min.
Climb to 9,000 m. (29,520 ft.) 16 min.
Service ceiling 11,100 m. (36,410 ft.).
Take-off distance to 15 m. (50 ft.) 900 m. (2,950 ft.).
Endurance at 560 km.h. (348 m.p.h.) at 9,000 m. (29,520 ft.) 1.55 hours.
Endurance at 480 km.h. (298 m.p.h.) at 9,000 m. (29,520 ft.) 1.85 hours.
Range at 560 km.h. (348 m.p.h.) at 9.000 m. (29,520 ft.) including climb to altitude 1,000 km. (620 miles).

PERFORMANCE (Rolls-Royce Nene 3 engine).—
Max. speed at 6,000 m. (19,680 ft.) at combat rating 831 km.h. (516 m.p.h.).
Mean cruising speed at 9,000 m. (19,680 ft.) 620 km.h. (385 m.p.h.).
Min. speed at S/L. (flaps 45°) 145 km.h. (90 m.p.h.).
Max. rate of climb at S/L. 1,650 m./min. (5,412 ft./min.).
Climb to 3,000 m. (9,840 ft.) 2.1 min.
Climb to 6,000 m. (19,680 ft.) 4.7 min.
Climb to 9,000 m. (29,520 ft.) 8.4 min.
Climb to 10,500 m. (34,440 ft.) 11.2 min.
Service ceiling 12,900 m. (42,310 ft.).
Take-off distance to 15 m. (50 ft.) 730 m. (2,395 ft.).
Endurance at 560 km.h. (348 m.p.h.) at 9,000 m. (29,520 ft.) 1.50 hours.
Endurance at 480 km.h. (298 m.p.h.) at 9,000 m. (29,520 ft.) 1.70 hours.
Range at 560 km.h. (348 m.p.h.) at 9,000 m. (29,520 ft.), including climb to altitude 910 km. (565 miles).

NORWAY

HÖNNINGSTAD

NORSK FLYINDUSTRI A/S. (incorporating Birger Hönningstad A/S.).

HEAD OFFICE AND WORKS: POST BOX 282, LYSAKER, FORNEBU, NEAR OSLO.

Directors: K. F. Oppegaard (Chairman), J. T. Haugen, Finn Friis, Olaf. R. Bjercke, Birger Hönningstad (Technical Manager), Einar Elvrum (Business Manager).

The original firm Birger Hönningstad A/S. was established in 1936 at Sköyen, near Oslo, by the Norwegian aeronautical engineer Birger Hönningstad and before the war two aircraft had been designed. These were the Norge Model A, which flew in 1938, and the C-5. The prototype of the C-5 was built in the workshops of Wideröe's Flyveselskap.

In 1946 the Hönningstad factory and offices were moved to the Fornebu Airport, Oslo, and in 1947 the name of the company was changed to Norsk Flyindustri A/S. (Norwegian Aircraft Industry, Ltd.).

In 1949 the company completed the Type 5-A Finnmark twin-engined amphibian flying-boat, this craft making its first flight on September 17 of that year. The Type 5-A has been described and illustrated in the last three editions of "All the World's Aircraft."

The company also specialises in the design and construction of metal floats, of which a number has been delivered for different types of aircraft.

WIDERÖE

WIDERÖE'S FLYVESELSKAP OG POLARFLY A/S.

HEAD OFFICE: KR. AUGUSTSGATE 19, OSLO.

WORKS: FORNEBU AIRPORT, OSLO.

Managing Director: Viggo Wideröe.

Wideröe's Flyveselskap og Polarfly A/S, which began operating in 1933, is the oldest flying company in Norway. It engages in general flying, including feeder line, charter, taxi and ambulance flying, aerial photography and air mapping.

The company's workshops at the Fornebu Airport are fully-equipped to undertake all overhaul and repair of aircraft and aero-engines.

The company built the C.5 Polar monoplane which was designed by Engineer Birger Hönningstad to the requirements of the Wideröe's Aviation Company.

This aircraft, which has been described and illustrated in previous editions of this Annual, took part in the Norwegian-British-Swedish expedition to the Antarctic in 1950-51, where large areas of Crown Princess Martha Land were photographed from the air.

THE PHILIPPINE REPUBLIC

INSTITUTE OF SCIENCE AND TECHNOLOGY.

Harran Street, Manila, P.I.

Director: Dr. Joaquin Marañon.

In charge, Engineering Research Division: Eng. Antonio J. de Leon.

The Institute of Science and Technology, Manila, is conducting a programme of research and study to investigate the possibilities of aircraft construction in the Philippines. This work is being undertaken by the Engineering Research Division under the direction of Engineer Antonio J. de Leon.

As part of this programme the Institute has designed, built and flown the XL-14 Maya experimental monoplane. The main object in building the XL-14 was to test the application of locally available materials, such as home-grown woods, plywood, bamboo, and allied products, to aircraft construction. One experimental material under test is "Wobex," which is a form of reinforced woven bamboo, and is used to cover the fuselage.

Initial tests with the XL-14 have given encouraging results and eventual improvements and developments are to be expected. The Institute had, at the time of writing, a second aircraft—the XL-15—in the initial construction stage. This will be an ambulance aircraft and will be powered by a 190 h.p. Lycoming engine.

A description of the XL-14 Maya follows.

THE XL-14 MAYA.

Type.—Three-seat Experimental monoplane suitable for agricultural uses, general utility and observation.

Wings.—High-wing strut-braced monoplane. Centre-section integral with fuselage cabin section. Outer wings braced by Vee struts. Structure consists of two parallel solid wood spars, wood ribs, "Wobex" reinforced bamboo mat leading-edge reinforcement and fabric covering. Slotted flaps and ailerons. Gross wing area 16 m.² (172.2 sq. ft.).

Fuselage.—Semi-monocoque structure with wood stringers and "Wobex" (woven bamboo) covering.

Tail Unit.—Strut-braced tailplane with end-plate type fins and rudders. All-wood construction with fabric covering.

Landing Gear.—Fixed tail-wheel type. Two side Vees and two half axles hinged to centre-line of underside of fuselage through rubber - in - compression shock - absorbers. Steerable tail-wheel.

Power Plant.—One 100 h.p. Lycoming O-235-2 four-cylinder horizontally-opposed air-cooled engine. Two-blade fixed-pitch wood airscrew. Fuel capacity 68 litres (15 Imp. gallons).

Accommodation.—Enclosed cabin seating two side-by-side seats in front and one behind. Stick control to left front seat. The rear seat is limited to a 50 kg. (110 lb.) passenger only or baggage of equivalent weight.

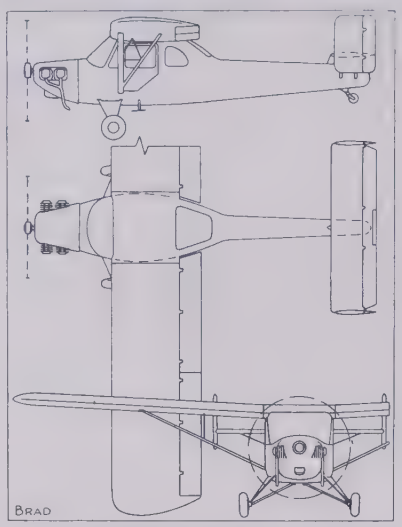
Dimensions.—
Span 10.24 m. (33 ft. 6 in.).
Length 6.30 m. (20 ft. 8 in.).
Height (tail up) 2.4 m. (7 ft. 11 in.).
Height (tail down) 2.3 m. (7 ft. 6 in.).

Weights and Loadings.—
Weight empty 510 kg. (1,125 lb.).
Disposable load 270 kg. (595 lb.).
Weight loaded 780 kg. (1,720 lb.).
Wing loading 48.75 kg./m.² (10 lb./sq. ft.).
Power loading 7.8 kg./h.p. (17.2 lb./h.p.).

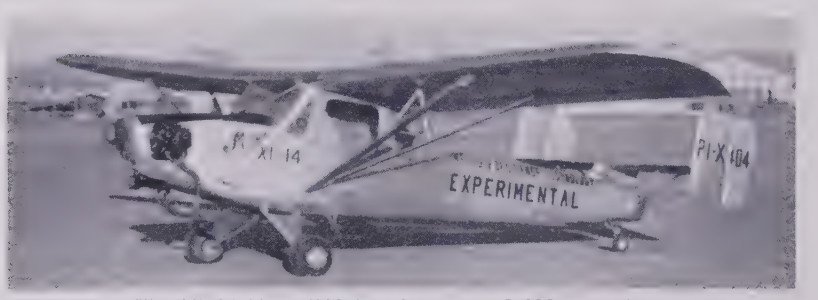
Performance.—
Max. speed 184 km.h. (115 m.p.h.).
Cruising speed 144-152 km.h. (90-95 m.p.h.).
Landing speed (without flaps) 83 km.h. (52 m.p.h.).
Landing speed (with flaps) 67-72 km.h. (42-45 m.p.h.).
Initial rate of climb 216 m./min. (708 ft./min.).
Service ceiling 3,820 m. (12,500 ft.).
Take-off distance to clear 20 m. (65 ft.) with flaps 350 m. (1,150 ft.).
Range 480 km. (300 miles).



The XL-14 Maya (100 h.p. Lycoming O-235 engine).



The XL-14 Maya.



The XL-14 Maya (100 h.p. Lycoming O-235 engine).

POLAND

The Aircraft Industry of Poland is nationalised and conforms to the following organization.

The industry as a whole is incorporated in the **Zjednoczenie Przemyslu Lotniczego (Z.P.L.)**, or United Aircraft Industry, which comes under the jurisdiction of the Central Council for Armament Industries in the Ministry of Industry.

Z.P.L. has two sub-divisions, one responsible for the design and manufacture of prototypes and the other for series production.

The design and assembly of prototypes is the responsibility of the **Centralne Studium** organization, which is divided into the following three groups :—

Centralne Studium Samolotów which specialises in aircraft development.

Centralne Studium Silników which is concerned with engine research and development.

Centralne Studium Przyrzadów which is responsible for the development and testing of aircraft, engine and navigational instruments.

Series manufacture of aircraft, engines and instruments and equipment is handled by the three following manufacturing groups :—

Państwowe Zaklady Lotnicze (P.Z.L.), or State Aircraft Works, with factories at Mielec, Rzesów and Wroclaw (Breslau).

Państwowa Wytwórnia Czesci Lotniczych (P.W.C.L.), or State Aircraft Parts Plant, with works at Lódz, Kamienna Góra and Lubawka.

Państwowa Fabryka Sprawdzianów Pryzrzadów Lotniczych, or State Aircraft and Navigational Instrument Works, with factories at Jelonia Góra.

The design and development of aircraft prototypes, the ultimate production of which is the responsibility of the P.Z.L. (see above), is undertaken by the **Lotnicze Warsztaty Doswiadczaine** (L.W.D.), or Aircraft Experimental Workshops at Lódź, which comes under the control of the Ministry of Communications.

The **Glowny Instytut Lotnictwa** (Chief Aviation Institute) in Warsaw is a research and testing establishment which is organized on the lines of the Russian Ts.A.G.I.

Finally, the **Instytut Szybownictwa** (Gliding Institute) designs and builds gliders and sailplanes. Its principal factory is at Bielsko, with a subsidiary factory at Jezów.

The L.W.D. was responsible for the production of the first aeroplane to be built in Poland since 1939. This was the Szpak-2, the prototype of which carried the registration SP-AAA to be the first civil aeroplane of the new *regime*. The Szpak-2 was designed during the last stages of the war in Lublin by Engineers Tadeusz Soltyk, Eugeniusz Stankiewicz and Witold Soltyk.

Since then the L.W.D. design staff under T. Soltyk has produced the Szpak-3, Szpak-4, the Zak-1, Zak-2, Zak-3, Junak, Zuch-1 and Zuch-2. The Mis feederliner was to have been produced in 1948 but was held up to allow work to proceed with the Junak and it is doubtful if it was ever completed.



The Szpak-4A Two-seat Advanced Trainer (150 h.p. Siemens Sh.14 engine).

The Centralne Studium Samolotow (C.S.S.) has produced the C.S.S.10 and 11 and was developing the C.S.S.12 twin-engined feeder liner but it is believed that the last-mentioned has been shelved.

The P.Z.L. only produced one design of its own, the S-1, and since then has only built L.W.D. types.

Types designed by L.W.D. are the Szpak-2, 3, 4A and 4T, Zak-1, 2 and 3, Junak, Zuch-1 and 2. The Zak-3 was the first to be produced in quantity.

THE SZPAK-4A.

TYPE.—Two-seat Aerobatic Trainer.
WINGS. — Low-wing monoplane. Wings braced to upper fuselage longerons by parallel steel tube struts. All-wood structure. Gross wing area 17.6 m.² (189.5 sq. ft.).
FUSELAGE.—Rectangular wood structure.
TAIL UNIT.—Cantilever monoplane type.
LANDING GEAR.—Fixed type. Each main wheel carried by a deformable pyramid, the telescopic sprung leg being anchored to the front wing spar and the two bracing members to the lower fuselage longerons at the wing spar attachment points. Wheel brakes. Main wheel track 2.5 m. (8ft. 2 in.).
POWER PLANT.—One 150 h.p. Bramo Sh.14 radial air-cooled engine.
ACCOMMODATION.—Open cockpit seating two side-by-side with dual controls.
DIMENSIONS.—
Span 11.3 m. (37 ft.).
Length 8.6 m. (28 ft. 2 in.).
Height 2.3 m. (7 ft. 8 in.).
WEIGHTS.—
Weight empty 620 kg. (1,367 lb.).
Weight loaded 900 kg. (1,985 lb.).
PERFORMANCE.—
Max. speed 168 km.h. (104.3 m.p.h.).
Cruising speed 135 km.h. (84 m.p.h.).
Min. speed 60 km.h. (37 m.p.h.).
Initial rate of climb 2.5 m./sec. (490 ft./min.).
Service ceiling 3,500 m. (11,480 ft.).
Range 450 km. (280 miles).

THE SZPAK-4T.

The Szpak-4T is a four-seat touring version of the 4A. The structure, powerplant and dimensions are the same as for the Szpak-4A described above. The four occupants are accommodated in an enclosed cabin and are seated in two pairs.
DIMENSIONS.—
Same as for Szpak-4A.
WEIGHTS.—
Weight empty 650 kg. (1,433 lb.).
Weight loaded 1,200 kg. (2,645 lb.).
PERFORMANCE.—
Max. speed 195 km.h. (121 m.p.h.).
Cruising speed 160 km.h. (100 m.p.h.).
Min. speed 65 km.h. (40.3 m.p.h.).
Initial rate of climb 2.3 m./sec. (450 ft./min.).
Service ceiling 3,300 m. (10,825 ft.).
Range 700 km. (435 miles).



The Zak-1 Two-seat Trainer (75 h.p. Walter Mikron engine).

THE ZAK-1.

TYPE.—Two-seat Trainer.
WINGS.—Low-wing cantilever monoplane. All-wood structure with plywood and fabric covering. One main spar and one diagonal auxiliary centre-section spar. Inset ailerons. Gross wing area 17 m.² (183 sq. ft.).
FUSELAGE.—Welded steel tube structure covered with fabric.
LANDING GEAR.—Fixed type. Each main wheel sprung by an oleo shock-strut the upper end of which is attached to lower fuselage longeron at the wing spar attachment and the lower end hinged by Vee struts to the centre-line of the underside of the fuselage. Wheels have brakes and low-pressure tyres. Main wheel track 2.5 m. (8 ft. 2 in.).
POWER PLANT.—One 75 h.p. Walter Mikron II four-cylinder inverted in-line air-cooled engine.
ACCOMMODATION.—Enclosed cockpit seating two side-by-side. Full dual controls. Adjustable seats.
DIMENSIONS.—
Span 11.8 m. (38 ft. 8½ in.).
Length 7.7 m. (25 ft. 3 in.).
Height 2.0 m. (6 ft. 7 in.).
WEIGHTS.—
Weight empty 380 kg. (837 lb.).
Weight loaded 580 kg. (1,277 lb.).
PERFORMANCE.—
Max. speed 157 km.h. (97 m.p.h.).
Cruising speed 130 km.h. (81 m.p.h.).
Min. speed 62 km.h. (38.5 m.p.h.).
Initial rate of climb 2.3 m./sec. (450 ft./min.).
Service ceiling 3,600 m. (11,810 ft.).
Range 400 km. (248 miles.).

THE ZAK-2.

The Zak-2 is an open-cockpit trainer which is powered with a 52 h.p. Continental A50 flat-four air-cooled engine. In all other respects it is similar to the Zak-1 described above.
DIMENSIONS.—Same as for Zak-1 except length 7.5 m. (24 ft. 7 in.).
WEIGHTS. Same as for Zak-1.
PERFORMANCE.—
Max. speed 150 km.h. (93 m.p.h.).
Cruising speed 120 km.h. (75 m.p.h.).
Min. speed 62 km.h. (38.5 m.p.h.).
Service ceiling 3,400 m. (11,155 ft.).
Range 400 km. (248 miles).

THE ZAK-3.

The Zak-3 is the same as the Zak-1 except that it is powered with a 65 h.p. Walter Mikron I engine.
DIMENSIONS.—
Span 11.8 m. (38 ft. 8½ in.).
Length 7.6 m. (23 ft. 11 in.).
Height (tail down) 1.95 m. (6 ft. 5 in.).
WEIGHTS AND LOADINGS.—
Weight empty 400 kg. (880 lb.).
Weight loaded 620 kg. (1,365 lb.).
Wing loading 36 kg./m.² (7.38 lb./sq. ft.).
Power loading 9.54 kg./h.p. (21 lb./h.p.).
PERFORMANCE.—
Max. speed 160 km.h. (100 m.p.h.).
Cruising speed 130 km.h. (81 m.p.h.).
Min. speed 62 km.h. (38.5 m.p.h.).
Initial rate of climb 2.7 m./sec. (520 m./min.).
Service ceiling 3,500 m. (11,480 ft.).
Range 400 km. (248 miles).

THE C.S.S. 10.

TYPE.—Two-seat Training monoplane.
WINGS.—Low-wing cantilever monoplane. All-wood single-spar structure. Leading-edge letter-box slots ahead of ailerons. Wing area 15.7 m.² (168 sq. ft.).

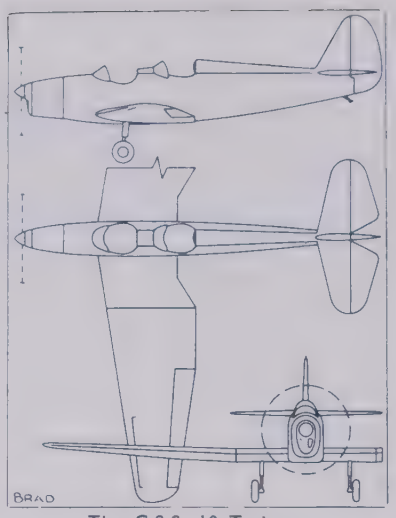
FUSELAGE.—Welded steel-tube structure covered with metal panels forward and fabric aft.
TAIL UNIT.—Cantilever monoplane type. Wood and fabric construction.
LANDING GEAR.—Fixed type. Single cantilever shock struts. Tail-skid.
POWER PLANT.—One 65 h.p. Walter Mikron 4-III four-cylinder in-line inverted air-cooled engine.
ACCOMMODATION.—Tandem open cockpits with dual controls.
DIMENSIONS.—
Span 10.58 m. (34 ft. 8 in.).
Length 7.36 m. (24 ft. 1 in.).
Height 3.15 m. (10 ft. 4 in.).
WEIGHTS (designed).
Empty 345 kg. (760 lb.).
Loaded 565 kg. (1,243 lb.).
PERFORMANCE (C.S.S. 10A).—
Max. speed 160 km.h. (100 m.p.h.).
Cruising speed 135 km.h. (83.5 m.p.h.).
Landing speed 67 km.h. (43.5 m.p.h.).
Ceiling 4,250 m. (13,940 ft.).
Range 600 km. (373 miles).

THE C.S.S. 11.

TYPE.—Two-seat Training monoplane.
WINGS.—Low-wing cantilever monoplane. Wooden single-spar construction. Wing area 15.7 m.² (168 sq. ft.).
FUSELAGE.—Welded steel-tube structure with metal and fabric covering.
TAIL UNIT.—Cantilever monoplane type.
LANDING GEAR.—Fixed tail-wheel type. Cantilever shock-absorber legs. Swivelling tail-wheel.
POWER PLANT.—One 160 h.p. Walter Minor 6-III six-cylinder in-line inverted air-cooled engine.
ACCOMMODATION.—Tandem open cockpits with dual controls.
DIMENSIONS.—
Span 10.58 m. (34 ft. 8 in.).
Length 7.5 m. (24 ft. 8 in.).
Height 2.15 m. (7 ft. 0 in.).
WEIGHTS.—
Loaded (aerobatic) 850 kg. (1,880 lb.).
Loaded (normal) 940 kg. (2,070 lb.).
PERFORMANCE (two-seater tourer).—
Max. speed 226 km.h. (140 m.p.h.).
Cruising speed 171 km.h. (105 m.p.h.).
Landing speed 86 km.h. (53 m.p.h.).
Ceiling 6,400 m. (20,990 ft.).
Range 1,090 km. (680 miles).

THE IS-1 SEP (VULTURE).

TYPE.—Single-seat High-performance Sailplane.
WINGS.—Gull-wing cantilever monoplane. Aspect ratio 18. Wing section G549 from root to point where dihedral ceases, remainder M12. Single-spar wood structure with false spar to which flaps and ailerons are hinged. Ailerons, slotted and differentially-controlled, are each in two sections, the inner sections linked with the slotted flaps so that they are lowered in ratio of 1 : 3 to the flaps. Dive-brakes on underside of leading-edge for 30% of span. Gross wing area 17 m.² (182.7 sq. ft.).
FUSELAGE.—All-wood structure of elliptical cross-section.
TAIL UNIT.—Cantilever monoplane type with single-fin and rudder. All tail surfaces of section NACA 0012. Trim-tab in port elevator.
DIMENSIONS.—
Span 17.5 m. (56 ft. 10 in.).
Length 7.5 m. (24 ft. 7 in.).
Height 1.43 m. (4 ft. 9 in.).
WEIGHTS AND LOADINGS.—
Normal loaded 290 kg. (638 lb.).
Max. loaded 315 kg. (693 lb.).

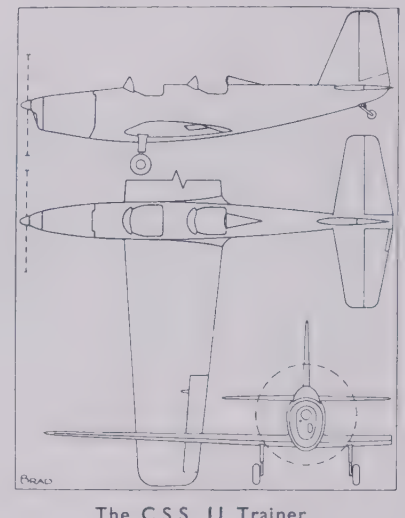


The C.S.S. 10 Trainer.

Max. wing loading 18.5 kg./m.² (4.625 lb./sq. ft.).
PERFORMANCE.—
Max. diving speed 250 km.h. (155 m.p.h.).
Min. speed (flaps at 40°) 40 km.h. (25 m.p.h.).
Min. rate of descent 6 m./sec. (1.92 ft./sec.).

THE IS-2 MUCHA (FLY).

The IS-2 is a single-seat intermediate sailplane. It is a high-wing monoplane, the wing being a single spar structure with an aspect ratio of 15, and is fitted with dive-brakes and spoilers. The fuselage is of elliptical cross section.
DIMENSIONS.—
Span 15 m. (49 ft. 3 in.).
Length 7 m. (22 ft. 11 in.).
Height 1.36 m. (4 ft. 2 in.).
WEIGHTS AND LOADINGS.—
Loaded 210 kg. (462 lb.).
Wing loading 14 kg./m.² (2.86 lb./sq. ft.).



The C.S.S. 11 Trainer.

PERFORMANCE.—
Max. diving speed 250 km.h. (155 m.p.h.).
Min. rate of descent 0.62 m./sec. (1.98 ft./sec.).

THE IS-4 JASTRZAB (GOSHAWK).

TYPE.—Single-seat Aerobatic Sailplane designed for inverted flight.
WINGS.—High gull-wing monoplane. Aspect ratio 12. Parallel-chord centre-section slightly swept forward, tapered outer sections. All-wood construction. Flaps and dive brakes fitted. Wing area 12 m.² (129 sq. ft.).
FUSELAGE.—Oval section all wood structure.
TAIL UNIT.—Cantilever monoplane with single fin and rudder. All wood construction.
LANDING GEAR.—Ventral skid and small auxiliary tail skid.
ACCOMMODATION.—Enclosed cockpit with moulded one-piece detachable hood.
DIMENSIONS.
Span 12 m. (39 ft. 4½ in.).
Length 6 m. (19 ft. 8¼ in.).
Height 1.2 m. (3 ft. 11 in.).
WEIGHTS AND LOADINGS.—
Weight empty 150 kg. (330 lb.).
Weight loaded 280 kg. (616 lb.).
Wing loading 24 kg./m.² (4.92 lb./sq.ft.).
PERFORMANCE.—
Rate of descent at 70 km.h. (43.5 m.p.h.) 1.05 m./sec. (3.42 ft./sec..)
Max. gliding ratio at 90 km.h. (56 m.p.h.) 1 : 23.5.
Safety factor 7.
PERFORMANCE (inverted).—
Rate of descent at 70 km.h. (43.5 m.p.h.) 1.05 m./sec. (3.42 ft./sec.).
Max. gliding ratio at 80 km.h. (50 m.p.h.) 1 : 21.5.

THE IS-6-X NIETOPERZ (BAT).

TYPE.—Experimental tail-less Sailplane.
WINGS.—Cantilever mid-wing monoplane. Aspect ratio 10. All wood structure with plywood covering to false spar to which ailerons are attached. Parallel-chord swept-forward centre section integral with fuselage. Swept-back outer sections. Ailerons occupy whole of outer section trailing-edges and are in two sections, the inner ailerons of wood and fabric and the outer ailerons of metal construction. All ailerons operated by control column either differentially as ailerons or in unison as elevators. An air brake lever splits both outer ailerons to act as air brakes. The first prototype fitted with rudder, but in second version rudder will be dispensed with and rudder pedals will be used to split one or other of the outer ailerons for directional control. Landing flaps on trailing-edge of centre-section. Gross wing area 14.4 m.² (155 sq. ft.).
FUSELAGE.—Oval section structure of all-wood construction.
LANDING GEAR.—Large ventral skid with small auxiliary skid aft.
ACCOMMODATION.—Enclosed cabin seating pilot.
DIMENSIONS.—
Span 12 m. (39 ft. 4½ in.).
WEIGHTS.—
Weight loaded 265 kg. (583 lb.).
PERFORMANCE.—
Rate of descent at 85 km.h. (53 m.p.h.) 1.03 m./sec. (3.38 ft./sec.).
Max. gliding ratio 1 : 23.
Min. speed 60 km.h. (37 m.p.h.).

THE IS OSA (WASP).

The Osa is basically an IS-2 fitted with a laminar-flow wing intended for a two-seat high-performance sailplane. No further details are available.

PORTUGAL

GOVERNMENT WORKSHOPS

OFICINAS GERAIS DE MATERIAL AERONAUTICO (GENERAL AERONAUTICAL MATERIAL WORKSHOPS).

ALVERCA DO RIBATEJO.

Director: Lieut. Colonel Engineer Bernardo Tiago Mira Delgado.

Sub-Director: Capt. Engineer Fernando Alberto de Oliveira.

This is the only establishment in Portugal which has built aircraft, and it belongs to the Ministry for War. Manufacture of aircraft, aero-engines and equipment has been by licence.

All repair and overhaul work on aeroplanes of the Air Force is done at this factory, as well as the overhaul of engines and instruments for civil aviation.

RUMANIA

Before the war the principal aircraft and aero-engine manufacturing organization in Rumania was the Regia Autonoma Industria Aeronautica Romana, a state establishment controlled by the Ministries of War and Marine. Apart from building aircraft of its own design under the initials I.A.R. for the Rumanian Air Force, it also manufactured Gnôme-Rhône engines under licence. It had previously built Morane-Saulnier, Potez, Fleet (U.S.A.) and PZL (Polish) aircraft under licence.

After the war the I.A.R. factory at Brasov was de-militarised by the Soviet occupation authorities and later a Soviet-Rumanian commercial agreement provided for the conversion of the establishment into a general engineering undertaking under joint Soviet-Rumanian ownership under the name Sovromtractor. Its principal production is, as its name implies, tractors and agricultural machinery.

The Project Engineering Division of Sovromtractor was, however, responsible in 1948-49 for the design and manufacture of a prototype light aeroplane, the I.A.R. 811. This was the first aircraft to be produced in Rumania since the end of the war. The prototype, which was fitted with a 60 h.p. Train engine, a French power-unit which is no longer in production, flew for the first time in May, 1949.

No recent information concerning the aircraft, which has been described in previous editions of this Annual, nor of any other aviation activities of Sovromtractor have become available during the past year.

SOVIET UNION

(Union of Soviet Socialist Republics)

The Soviet State Aircraft Industry comes under the direct jurisdiction of the Ministry of the Aircraft Industry.

Technical organization of the aircraft industry is shared by three establishments, TsAGI (Central Aero-Hydrodynamics Institute), founded in 1918, which deals with all aircraft developments; TsAIM (founded in 1930), which does the same for aero-engines; and VIAM (founded in 1932), which conducts and directs research on alloys and testing of all aircraft materials.

The Ministry of Aircraft Industry supervises a total of something like 360 State factories, of which eighty-five are producing airframes and about thirty are building aero-engines. Many of these factories were originally located in the west in areas where labour and transport were readily available.

Part of the main strategic distribution of Russia's principal industries, however, has depended on the development of the vast natural resources of the inner regions of the Soviet Union and in recent years the expansion of the Aircraft Industry has mainly taken place in Central Russia and in the East.

Russia is also taking advantage of the production facilities of the aircraft industries of some of the satellite countries, including Czechoslovakia and Poland.

ANTONOV

OLEG. K. ANTONOV.

Antonov, an important glider designer, has a number of his sailplane types, and probably some cargo-gliders, in use in the U.S.S.R. The A-1 is a single-seat elementary training glider; the A-2 is a two-seat primary training glider, a slightly modified US-5 (see the 1951-52 edition); and the A-9 is a single-seat high-performance sailplane. In July, 1951, Marina Pyaleva put up the out-and return "goal" flight record to 226.29 km. (140.5 miles) on an A-9.

In early 1952, Antonov and three collaborators were awarded a Stalin Prize of 100,000 roubles for work in the field of aircraft construction in the "transport and commercial" section.

Antonov is now known to have been associated with the design of the AN-2 single-engined biplane passenger-carrier, an illustration of which appears herewith.

THE AN-2.

The AN-2 is a large passenger-carrying biplane which was first known to be in service in 1950. Low wing-loading, ample flap area, etc. would seem to indicate that the AN-2 was specially designed for operation from small airfields in mountainous regions.



The AN-2 Biplane Transport (ASR-21 radial engine).

TYPE.—Single-engined Passenger B iplane.
WINGS.—Single-bay unequal-span biplane. I-type interplane struts. Ailerons and flaps in upper and lower wings.
FUSELAGE.—Circular section all-metal structure.
TAIL UNIT.—Monoplane type with small bracing struts below tailplane.
LANDING GEAR.—Fixed tail-wheel type.
POWER PLANT.—One ASh-21 seven-cylinder radial air-cooled engine. Four-blade airscrew.
ACCOMMODATION.—Crew's cabin well glazed, with overhang for downward vision, mounted forward of top wing. Passenger cabin (accommodation unknown) with baggage compartment aft.
EQUIPMENT.—Includes radar aids for landing.
DIMENSIONS (Approx.).—
Span 14.2 m. (46 ft. 8 in.).
Length 11.36 m. (37 ft. 2 in.).
WEIGHTS AND PERFORMANCE.—
No data available.

ILYUSHIN

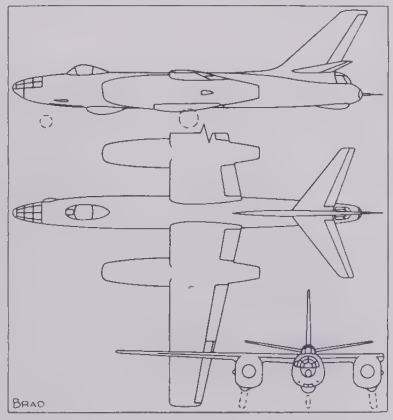
SERGEI ILYUSHIN.

Ilyushin is an active designer of diverse aircraft types. In March, 1952, in collaboration with ten co-workers, he was awarded a Stalin Prize of 150,000 roubles for "new work in aircraft construction." At the time of writing he is represented mainly by the IL-10 and IL-12 and by the twin-jet bomber known as "Type 27." The latter has a number of features in common with "Type 35," which is attributed to A. N. Tupolev; this may be evidence that Ilyushin and Tupolev collaborated in the design of "Type 27."

THE ILYUSHIN IL-28.

The IL-28 twin-jet light attack bomber was seen for the first time at the 1950 Aviation Display and is now in service in numbers in the U.S.S.R. and in Eastern Germany. It is a shoulder-wing monoplane with straight leading-edge and swept-forward trailing-edge, but all tail surfaces are swept-back. It is powered with two RD-45 centrifugal-flow turbojet engines.

Details of armament and bomb load



The Ilyushin IL-28.



The Ilyushin IL-28 twin-jet Bomber shown here with tip tanks

are not known, but it has been reported that there are two heavy calibre guns in the lower part of the fuselage nose and two guns in a tail position.

DIMENSIONS (Approx.).—
Span 22.0 m. (72 ft. 2 in.).
Length 20.0 m. (65 ft. 7 in.).
PERFORMANCE.—
Max. speed about 975 km.h. (605 m.p.h.).

THE ILYUSHIN U-IL-28 TRAINER.

In 1951 there appeared a trainer version of the IL-28 bomber. This differs



The Ilyushin IL-12A Airliner (two 1,775 h.p. ASh-82FNV engines). (*F. G. Swanborough*).

from the operational version in having a stepped-down tandem cockpit arrangement and may not carry all the armament of the bomber version. Several have been seen in Germany.

THE IL-12.

The IL-12 is the standard medium-range airliner used by Aeroflot. The IL-12 is also in service with C.S.A. (Czechoslovak Airlines) and L.O.T. (Polish Airlines).

A military version of the IL-12 has been in use for three or four years. This is probably a general-purpose aeroplane capable of functioning as troop-carrier, freighter and glider-tug. Gliders which have been towed include the large 1949 Yakovlev and Tsibin types. This version of the IL-12 has gun ports for small arms in the windows, and is provided with large double doors on the port side of the rear fuselage for the loading of bulky items of equipment—and possibly also for the exit of parachute troops.

TYPE.—Twin-engined Transport monoplane.

WINGS.—Low-wing cantilever monoplane. Two spar metal structure, with metal stressed skin covering. Ailerons in outer panels, with trim tab in starboard aileron only. Split trailing-edge flaps, divided into two at junction of outer panels and centre section. Wing de-icing by warm air ducted through oil coolers and thence to leading-edges.

FUSELAGE.—Oval all-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type with single fin and rudder. May be seen with or without dorsal fin extension. Metal-clad fixed surfaces, control surfaces metal-framed, fabric-covered. Spring tab in rudder and elevators. Tailplane de-icing as for wings.

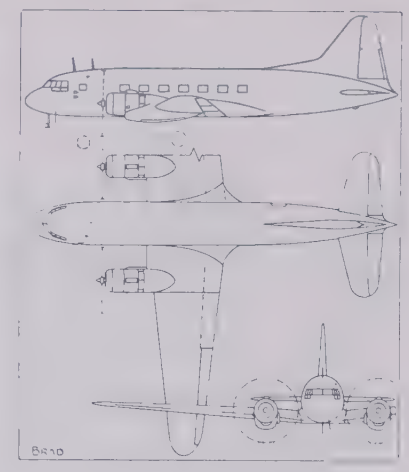
LANDING GEAR.—Retractable tricycle type. Single nose-wheel retracts rearwards into fuselage. Main wheel units, each with twin wheels, retract forward into engine nacelles. Detachable tail strut used during loading operations.

POWER PLANT.—Two ASh-82FNV fourteen-cylinder two-row radial air-cooled engines developing 1,775 h.p. for take-off at 2,400 r.p.m. Rated power 1,600 h.p. at 2,050 m. (6,730 ft.) and 1,350 h.p. at 5,540 m. (17,720 ft.). Four-blade metal constant-speed fully-feathering airscrews. Total fuel capacity (93-95 octane), 6,500 litres (1,435 Imp. gallons) in eight tanks, two in fuselage, two in centre section, two in each outer wing section.

ACCOMMODATION.—Crew of five, comprising pilot and co-pilot side-by-side, navigator and radio-operator on flight deck to rear of pilots, and stewardess. Accommodation for 27-32 passengers in air-conditioned main cabin. Standard version seats 27 in a row of nine single seats down the starboard side of cabin, and nine double seats down port side. Toilet compartment at rear.

EQUIPMENT. Night and blind-flying equipment, two-way V.H.F. and full radio installations.

DIMENSIONS.—
Span 31.7 m. (104 ft.).
Length 21.31 m. (69 ft. 10¾ in.).
Height 8.07 m. (26 ft. 6 in.).



The Ilyushin IL-12 Airliner.

WEIGHTS AND LOADINGS (27-passenger version).—
Empty weight 9,000 kg. (19,850 lb.).
Payload 3,000 kg. (6,610 lb.).
Loaded weight 17,250 kg. (38,000 lb.).
Take-off power loading 4.76 kg./c.v. (10.7 lb./h.p.).

PERFORMANCE.—
Max. speeds 365 km.h. (226 m.p.h.) at sea level.
370 km.h. (230 m.p.h.) at 500 m. (1,640 ft.).
385 km.h. (239 m.p.h.) at 1,000 m. (3,280 ft.).
407 km.h. (252 m.p.h.) at 2,500 m. (8,220 ft.).
Cruising speeds 325 km.h. (202 m.p.h.) at sea level.
335 km.h. (208 m.p.h.) at 1,000 m. (3,280 ft.).
350 km.h. (217 m.p.h.) at 2,500 m. (8,220 ft.).
345 km.h. (214 m.p.h.) at 3,000 m. (9,840 ft.).
Landing speed 145 km.h. (90 m.p.h.).
Take-off run 360 m.-520 m. (1,185 ft.-1,705 ft.).
Landing run 450 m. (1,475 ft.).
Single-engine ceiling 3,000 m. (9,840 ft.).
Range with 32 passengers 20 kg. (45 lb.) baggage each 1,250 km. (777 miles).
Range with 27 passengers 20 kg. (45 lb.) baggage each 2,000 km. (1,240 miles).
Range with 16 passengers (de luxe version) 3,000 km. (1,865 miles).

THE IL-10 SHTURMOVIK.

TYPE.—Two-seat Close-Support and Reconnaissance monoplane.

WINGS.—Low-wing cantilever monoplane. Metal structure and covering. Split flaps. Balanced two-piece ailerons with trim tabs.

FUSELAGE.—Oval section of all-metal construction and metal covering.

TAIL UNIT.—Cantilever monoplane type. Single fin and horn-balanced rudder. Fixed surfaces metal structure, metal covered. Control surfaces metal structure, fabric covering.

LANDING GEAR.—Tail-wheel type, main wheels retract hydraulically backwards, the oleo legs turning through 90° for the wheels to lie flush in the wings. Tail-wheel is semi-retractable.

POWER PLANT.—One 2,000 h.p. AM-42 twelve-cylinder Vee liquid-cooled engine driving a three-bladed constant-speed airscrew. Radiator below fuselage and armour plate on underside of engine.

ACCOMMODATION.—Pilot's cockpit with raised canopy above wing and enclosed gunner's position for rear defence. Extensive armour plate in cockpit.

ARMAMENT AND EQUIPMENT.—Two 23 mm. cannon and two 7.62 mm. machine-guns in the leading-edge of the wings. Armament may be varied for different missions. One hand-operated 12.7 mm. machine-gun in rear position. Four rocket-projectile guide-rails beneath each wing. Centre-section has internal stowage for two 500 kg. (1,100 lb.) bombs.

DIMENSIONS.—
Span 13.7 m. (44 ft. 11 in.).
Length 11.95 m. (39 ft. 3 in.).

WEIGHTS AND LOADINGS.—
No data available.

PERFORMANCE.—
Max. speed 450 km.h. (280 m.p.h.) at 2,130 m. (7,000 ft.).



The IL-10 Shturmovik Close-Support Monoplane.

KUPFER

M. A. KUPFER.

Kupfer is a young Moscow engineer who submitted the design of his "Smolensk" motorless rotorplane for a 1949 DOSAV competition. A prototype was later constructed and this may perhaps serve as a basis for a series of training rotor-gliders for future helicopter pilots.

The craft is launched by a length of cable. This is wound round a drum at the top of the rotor column, the loose end fixed to a stake, and the "Smolensk" is then towed by a light car until the rotor is spinning fast enough to cause the craft to ascend. The cable is jettisoned by the pilot who then returns to earth in autorotation.

It is said that helicopter type controls are fitted so that the pilot may familiarise himself with their handling during his short power-less flight.

DIMENSIONS.—
Length overall 3.9 m. (12 ft. 10 in.).
Height 1.57 m. (4 ft. 10 m.).

LAVOCHKIN

SEMYON A. LAVOCHKIN

As far as is known, Semyon Lavochkin has been exclusively a designer of fighter aeroplanes. At present the LA-9 and LA-11 piston-engined fighters and the LA-(17?) jet fighter ("Type 15") are in service in the U.S.S.R. and satellite nations.

Some LA-9's were identified among escorts of a formation of TU-2's of the Chinese air force in Korea in December, 1951, and some of them were shot down by U.S.A.F. fighters.

It now appears that the LA-11 differs very little in external appearance from the LA-9, and the overall dimensions may actually be the same. The ventral oil radiator of the LA-9 has been transposed to the lower part of the motor cowl front in the LA-11. Armament in the latter has been reduced to three cannon, which are probably of the VYa type. The LA-11 has a number of technical improvements, including an original form of de-icing.

The LA-(17?) jet fighter was reported on a few occasions as having been seen in the Korean skies.



The Lavochkin LA-(17?) Swept-wing Jet Fighter.

THE LA-(17?).

This aircraft while not definitely identified as such, is generally believed to be a Lavochkin design. It appears to be a standard type in the Soviet Air Forces and to be in service in some numbers.

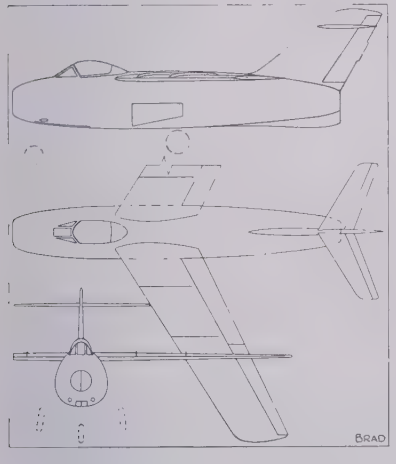
It is a single-seat interceptor jet-propelled monoplane with sweptback wings and tail-unit. The wing is mounted in the high mid-wing, or shoulder position and the tailplane is mounted high on the swept-back fin. The power-plant is probably a Russian copy of the Nene.

The landing-gear is a tricycle with all wheels retracting into the fuselage.

The armament consists of two cannon, probably 20 or 30 mm., which are mounted in the nose of the fuselage below the air intake.

DIMENSIONS (approximately). —
Span about 12.2 m. (40 ft.).
Length about 11.3 m. (37 ft.).

PERFORMANCE.—
Max. speed about 1,030 km.h. (640 m.p.h.).



The Lavochkin LA-(17?).

THE LA-11.

First evidence of the existence of the LA-11 was obtained in the Summer of 1949 when an aircraft of this type crash-landed in Sweden. The pilot, a young Russian lieutenant, sought political asylum in Sweden and the aircraft was returned to the U.S.S.R.

The LA-11 is basically a revised LA-9 with a 1,850 h.p. ASh-82 FNV two-row radial engine, and an armament of three 23 mm. cannon firing through the airscrew.

DIMENSIONS.—
Span 9.94 m. (32 ft. 7 in.).
Length 8.70 m. (28 ft. 6 in.).

WEIGHTS.—
No data available.

PERFORMANCE.—
Max. speed about 660 km.h. (about 410 m.p.h.) at 6,130 m. (20,000 ft.).

THE LA-9.

TYPE.—Single-seat Fighter.

WINGS.—Low-wing cantilever monoplane. Dihedral from wing roots. Slight taper on leading-edge, marked taper on trailing-edge to square-cut wing tips. Split flaps.

FUSELAGE.—Oval all-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure.

LANDING GEAR.—Retractable tail-wheel type. Main wheels retract inward and upward into wing and fuselage recesses. Tail-wheel retracts backwards into fuselage.

POWER PLANT.—One 1,850 h.p. ASh-82 FNV fourteen-cylinder two-row radial air-cooled engine driving a three-bladed constant-speed metal airscrew. Air coolant radiator beneath fuselage behind wing trailing-edge.

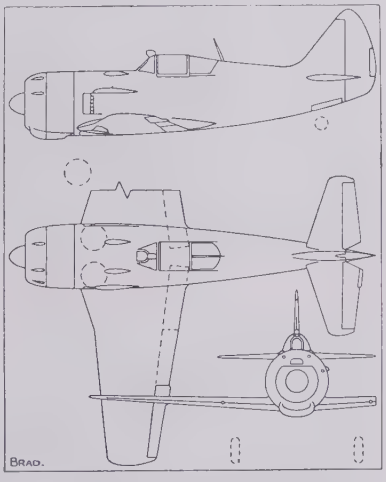
ACCOMMODATION.—Raised "teardrop" cockpit cover above wing trailing-edge. Armour protection for pilot.

ARMAMENT.—Four 23 mm. cannon in engine cowling above engine and synchronised to fire through the airscrew.

DIMENSIONS.—
Span 9.6 m. (31 ft. 5 in.).
Length 8.47 m. (27 ft. 10 in.).

WEIGHTS.—
No data available.

PERFORMANCE.—
Max. speed about 645 km.h. (400 m.p.h.).



The Lavochkin LA-11.

MIG.

ARTEM MIKOYAN AND MIKHAIL GUREVICH.

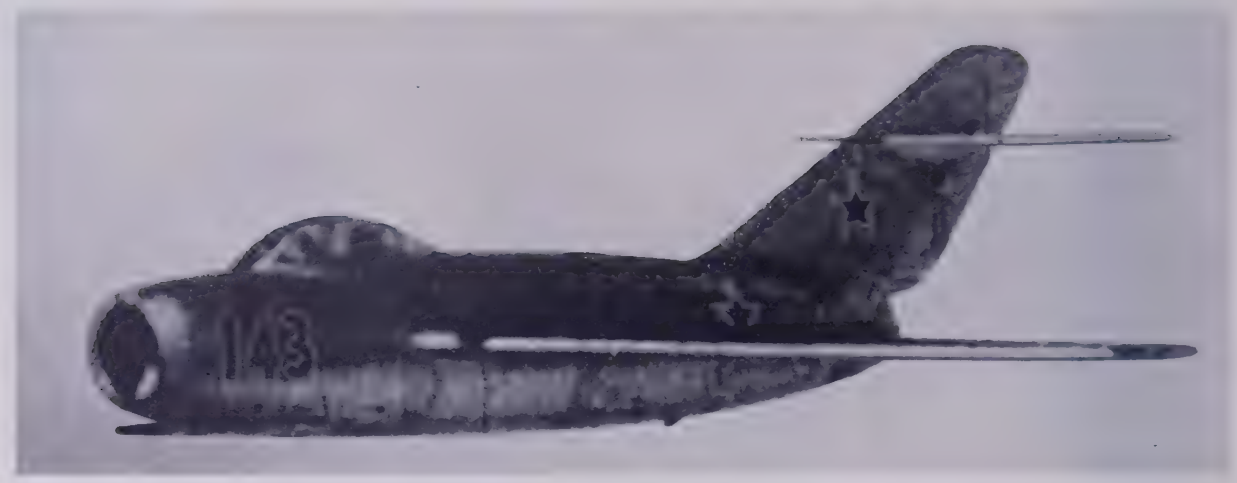
These two designers have collaborated for many years in the development of high-performance fighter aircraft.

In 1946 Mikoyan and Gurevich were responsible for the MIG-9, one of the first all-Russian jet fighters to go into squadron service. For this work they received a "Stalin Prize" in money form.

Although the MIG-9 was produced in large numbers and has been in service within the U.S.S.R. as well as in Eastern Germany, it is now considered to be obsolescent.

The modern trend of Russian fighter design is typified by the MIG-15 which has proved itself in action in Korea to be one of the World's best jet fighters.

The design of the MIG-15, which was begun in 1946, was the work of a team led by Mikhail I. Gurevich, who numbered among his collaborators several German engineers who were able to introduce some of the valuable experience obtained during the war in German research into advanced designs. Nevertheless, the achievement of the Russian technicians and engineers of the design team and of the TsAGI establishment, where much original research was undertaken, in designing and building in a little over one year an



The MIG-15 Single seat Swept-wing Fighter (RD-45 Turbojet engine).

aircraft of such advanced design as the MIG-15 (the first prototype flew in 1947), was a remarkable one.

The prototype MIG-15 was powered by one of the first Rolls-Royce Nene engines imported by Russia early in 1947. The technical analysis and break-down of the Nene engine and its materials; its re-design and preparation for production as the power-unit of the MIG-15, again in a little over a year, constitutes another outstanding achievement. The first production engine, now known as the RD-45, was ready early in 1948, and the production MIG-15 began to appear in squadron service in numbers in 1949.

In 1952-53 the MIG-15 was in widespread service in the U.S.S.R., Korea, Eastern Germany, Austria, Poland, and Czechoslovakia.

In March, 1952, Mikoyan, Gurevich and eighteen collaborators received a Stalin Prize (First Class) for "new work in aircraft construction."

The first fairly complete example of the MIG-15 to be examined by the Western allies was salved from shallow enemy waters off the North Korean coast by a British naval party in 1951. Since then two complete aircraft have been landed in Denmark by Polish pilots and were made available for examination by the Danish authorities before the aircraft were returned to Poland.

The general opinion of American pilots who have fought the MIG-15 is that above 35,000 ft. (10,675 m.) the MIG-15 is superior to the F-86E but that the latter gains an advantage below this level. It has been observed that some examples of the MIG-15 maintain superiority over the F-86 down to about 20,000 ft. (6,100 m.) which may indicate that at least two series differing in power-plants may exist.

The U.S. pilots were able to maintain superiority principally by their better training, greater agressiveness, superior gun-sights, and the use of the G-Suit.

Apart from the existence of progressive developments of the standard day fighter it is known that a night or all-weather fighter version with radome mounted above the nose air inlet exists. This version is shown in the line drawing on this page. There is also the U-MIG-15 unarmed two-seat trainer version which is in service in the Soviet Air Force.

THE MIG-15.

TYPE. -Single-seat Jet Fighter.

WINGS.—Mid-wing cantilever monoplane. Sweepback at leading-edge 42°. Dihedral –3°. Thickness/chord ratio 11 per cent constant. All-metal light alloy stressed-skin structure with two main I-section spars. The straight rear spar, which takes all main wing loads, is attached to a heavy steel and aluminium fuselage frame. The front spar is cranked forward from the landing-gear attachment point to serve as front wall of wheel-well, and is attached to another strong fuselage frame. A third short spar member, originating just outboard of the landing-gear hinge point, runs at right angles to the fuselage centre-line and transmits wing bending loads. Hydraulically-operated Fowler split flaps. Ailerons have both mass and sealed aerodynamic balances. Two stall fences on each wing. Gross wing area 23.7 m.² (255 sq. ft.).

FUSELAGE.—Semi-monocoque light alloy stressed-skin structure. In two main units, a forward assembly of nose and mid sections, and a rear section, joined by quick-release bolts at the rear wing spar attachment points; the rear fuselage being easily detachable for engine servicing. Air brakes on rear fuselage.

TAIL UNIT.—Cantilever monoplane type. Sweepback on fin and tailplane leading-edges 42°. Thickness chord ratio on all surfaces 8 per cent. Tailplane, high up fin, has single steel spar and light alloy frames and skin. The large fin has two spars, the rear spar of steel and the other spar, frames and skin of light alloy. Fin rear spar, which takes main flight loads, attached to heavy steel fuselage frame surrounding jet orifice. Tailplane incidence adjustable on ground only. Elevators and rudders of stressed light alloy construction. Electrically-operated trim-tab in port elevator. Both upper and lower rudders mass-balanced. Tailplane span 4.5 m. (14 ft. 10 in.).

LANDING GEAR.—Retractable tricycle. Air-oil shock absorbers. Main wheels, with levered suspension, raised inward, nose wheel forward. Hydraulic retraction, with emergency pneumatic system. Hydraulic wheelbrakes.

POWER PLANT.—One RD-45 centrifugal-flow turbojet engine (2,725 kg. = 6,000 lb. s.t.). Bifurcated nose air-inlet. Fuel tanks in mid fuselage section between the divided air intake ducts. Total internal fuel capacity 1,250 litres (330 U.S. gallons). Drop tanks 600 litres (160 U.S. gallons) each may be carried, one under each wing.

ACCOMMODATION.—Pressurised cockpit forward of wing leading-edge with sliding canopy. Max. pressure 4.2 lb./sq. in. from 26,000 ft. (7,930 m.) up. Oxygen system is provided for emergency use. Ejection seat with automatic release.

ARMAMENT.—Two 23 mm. cannon below port side of nose and one 37 mm. cannon below starboard side. Gyro gun-sight. Rockets or two 1,000 bombs may be carried under wings.

DIMENSIONS.
Span 10.10 m. (33 ft. 1½ in.).
Length 11.10 m. (36 ft. 4 in.).
Height 3.40 m. (11 ft. 2 in.).

WEIGHTS.—
Weight empty 3,780 kg. (8,320 lb.).



The MIG-15*bis* Single-seat Swept-wing Fighter which was flown to Denmark by a Polish pilot.

Weight loaded (combat) 5,120 kg. (11,270 lb.).
Max. loaded weight (with external fuel or bombs) 6,465 kg. (14,240 lb.).

PERFORMANCE.—
Max. speed approx. 1.072 km.h. (670 m.p.h.).
Stalling speed 175 km.h. (109 m.p.h.).
Initial rate of climb 3,170 m./min. (10,400 ft./min.).
Service ceiling 15,550 m. (51,000 ft.).

THE MIG-15*bis*.

TYPE.—Single-seat Jet Fighter.

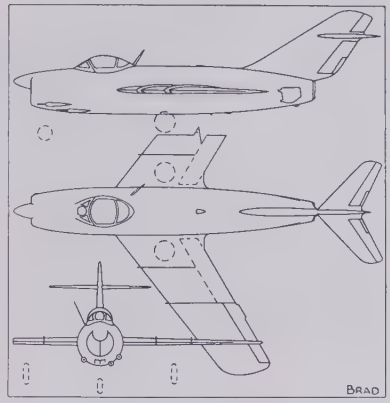
CONSTRUCTION.—As for standard MIG-15, but wings of MIG-15*bis* have perforated flaps.

POWER PLANT.—One VK-1 centrifugal-flow turbojet engine (2,700 kg. = 5,955 lb. s.t.).

FUEL.—T-77 kerosene. Internal capacity 1,410 litres (310.2 Imp. gallons) external fuel 490 litres (108 Imp. gallons).

ACCOMMODATION.—Pilot's seat below rear-sliding canopy.

ARMAMENT AND EQUIPMENT.—One 37 mm. cannon with 40 rounds on starboard side of lower front fuselage: two 23 mm. NS cannon each with 80 rounds on port side.



The MIG-15 All-weather Fighter.

Gyro gun sight. Attachments for auxiliary fuel tanks.

DIMENSIONS.—
Span 10.1 m. (33 ft. 1½ in.).
Length 11.1 m. (36 ft. 4 in.).
Wing area 17.25 m.² (186.7 sq. ft.).

WEIGHTS AND LOADINGS.—
Weight loaded 5,028 kg. (11,085 lb.).

PERFORMANCE.—
Max. speed between 1,100-1,200 km./hr. (684-746 m./hr.).
Stalling speed (clean) 210 km./hr. (131 m.p.h.).
Stalling speed (flap and L/G down) 190 km./hr. (118 m.p.h.).
Ceiling above 15,000 metres (49,200 ft.).
Endurance about 2 hours.

THE U-MIG-15.

TYPE.—Two-seat conversion trainer developed from MIG-15.

CONSTRUCTION.—Similar to fighter type.

POWER PLANT.—One RD-45 centrifugal turbine developed from Nene.

ACCOMMODATION.—Pupil and instructor sit in tandem under long raised canopy.

ARMAMENT.—Guns not carried but fairings are retained.

DIMENSIONS.—
Span 10.10 m. (33 ft. 1½ in.).
Length 11.10 m. (36 ft. 4 in.).

PERFORMANCE.—
Similar to that of MIG-15.

MIL

MIKHAIL L. MIL.

Mikhail Mil is a well-known worker in the field of rotating-wing aeroplanes. One of the first really successful Soviet helicopters, which should be capable of a wide range of duties, was exhibited at the 1951 Soviet Aviation Day Display at Tushino, and was a design from Mil's office. Full technical details are not yet available, but the general layout of the helicopter can be gathered from the accompanying photograph. The power-plant is reported to be an M-62IR—a pre-war nine-cylinder air-cooled radial of about 840 h.p. The approximate overall length of the helicopter is 11.6 m. (35 ft.) excluding rotors.



The MIL General-Purpose Single-rotor Helicoptor.

POLIKARPOV

NIKOLAI N. POLIKARPOV.

Polikarpov was the chief designer of fighter aircraft before the advent of the YAK, MIG and LAGG single-seat fighters in the late 1930s.

His best known and most used design is the PO-2 single-engined utility biplane. First produced in 1927 as the U-2, it has been used for every conceivable duty, military and civil, and is to-day serving as an elementary and aerobatic trainer, glider tug and air ambulance, as well as a short-haul passenger transport.

When Polikarpov died in July, 1944, he was a Deputy of the Supreme Soviet and was given special funeral honours in Moscow.

THE PO-2.

The PO-2 which first made its appearance in 1927, has remained in service with the Russian Air Force ever since. Civil examples are in service in Czechoslovakia and Poland and the type is in use in the air forces of Bulgaria, Poland and Yugoslavia. In addition to its use as a trainer and communications type with the Russian Air Force, the PO-2 has been adapted for use as an ambulance, light freighter, glider tug and as a crop-duster.

TYPE.—Two-seat Light Communications and Training Biplane.

WINGS.—Single-bay unequal-span braced staggered biplane. Wooden two-spar and rib structure, with fabric covering. N-type interplane struts and between fuselage and top wing. Ailerons in upper and lower wings.

FUSELAGE.—Rectangular wooden structure, with formers and longerons, and curved decking on top of fuselage. Fabric covering.



The PO-2 Two-seat Training Biplane.

TAIL UNIT.—Monoplane type. Strut braced fabric covered wooden tailplane. Trim-tab on port elevator. Small wooden fin with straight, swept-back leading-edge, and large, rounded rudder; fabric covering. Control cables to tail surfaces are external.

LANDING GEAR.—Fixed cross-axle type, with shock absorbers on rear legs of side Vees. Fixed tail-skid. Wheels are interchangeable with skis.

POWER PLANT.—One 110 h.p. M-11 five-cylinder radial air-cooled engine. Welded steel-tube engine mounting and Dural skin covering. Two-blade fixed-pitch wooden airscrew.

ACCOMMODATION.—Tandem open cockpits, with full dual control.

DIMENSIONS.—
Span 11.4 m. (37 ft. 5 in.).
Length 8.14 m. (26 ft. 8 in.).
Height 2.9 m. (9 ft. 6 in.).
Wing area 33.1 m.² (356.8 sq. ft.).

WEIGHTS AND LOADINGS.—
Weight empty 610 kg. (1,342 lb.).
Weight loaded 870 kg. (1,910 lb.).
Wing loading 26.3 kg./m.² (5.67 lb./sq. ft.)
Power loading 7.90 kg./h.p. (17.36 lb./h.p.).

PERFORMANCE.—
Max. speed 155 km.h. (96 m.p.h.).
Cruising speed approx. 125 km.h. (75 m.p.h.).
Landing speed 56 km.h. (35 m.p.h.).
Initial rate of climb 3.3 m./sec. (640 ft./min.).
Service ceiling 4,000 m. (13,000 ft.).

SHCHERBAKOV

S. O. SHCHERBAKOV.

The ShchE-2 is probably the first design of Shcherbakov which has been adopted for quantity production, though apart from the fact that he is believed to have been active in pre-War days as a sailplane designer nothing is known of his work. The ShchE-2 came into service late in the 1941-1945 war as a light transport, and since 1945 it has been adopted for use over short distances by Aeroflot. Some have also been used on special work such as aerial survey. The ShchE-2 can also be adapted for use as an ambulance.

THE ShchE-2.

TYPE.—Twin-engined Troop-carrier, Freight transport and Ambulance.



The ShchE-2 Light Transport (two 145 h.p. M-11D engines).

WINGS.—High-wing strut-braced wing with dihedral from roots and tapering in thickness from root to tip. Wing has single taper on the leading-edge and compound taper on the trailing-edge, with blunt tip. Split trailing edge flap between ailerons and fuselage.

FUSELAGE. — Rectangular-section structure with straight top line and curved under-surface.

TAIL UNIT.—Cantilever monoplane type, with dihedral on tailplane and out-rigged oval fins and rudders.

POWER PLANT.—Two 145 h.p. M-11D five-cylinder radial air-cooled, uncowled, engines driving two-blade fixed-pitch wooden airscrews.

LANDING GEAR.—Fixed tail-wheel type. Unspatted main wheels on single struts attached to fuselage.

ACCOMMODATION.—Crew of two, plus eight fully equipped paratroops when used as a troop-carrier, or ten passengers when used as a civil airliner, or nine stretcher cases and an attendant when used as an ambulance. Freight load probably about 1,134 kg. (2,500 lb.).

DIMENSIONS.—
Span 21.95 m. (72 ft.).
Length 15.24 m. (50 ft.).

WEIGHTS.—
No data available.

PERFORMANCE.—
Max. speed (estimated) 152 km.h. (94.5 m.p.h.).
Range 644 km. (400 miles).

TSIBIN

P. V. TSIBIN.

Not a great deal is known about the activities of Tsibin, but he has been interested in glider design since at least as early as 1928, when his Khalturinets training glider appeared. Nothing more can be traced of him until about 1944 when the KTS-20 transport glider, designed in collaboration with D. N. Kolesnikov, became known. Authentic data on the configuration and performance of this glider are not available.

In 1949 two further troop and cargo-carrying gliders attributed to Tsibin appeared. Both are high-wing monoplanes but one is cantilever and the others strut-braced. The former is reputed to have a span of approximately 28 m. (92 ft.) and to have accommodation for 16-18 troops, while the latter is believed to have a span of about 24.4 m. (80 ft.). No other reliable information is available.

THE TSIBIN CARGO GLIDER.

This is a large troop or general transport glider which is reminiscent of the Airspeed Hamilcar in general arrangement. It is said to have accommodation for twenty-eight fully armed troops.

DIMENSIONS.—
Span about 22 m. (about 72 ft.).
Length about 15.5 m. (about 51 ft.).

TUPOLEV

ANDREI NIKOLAEVICH TUPOLEV.

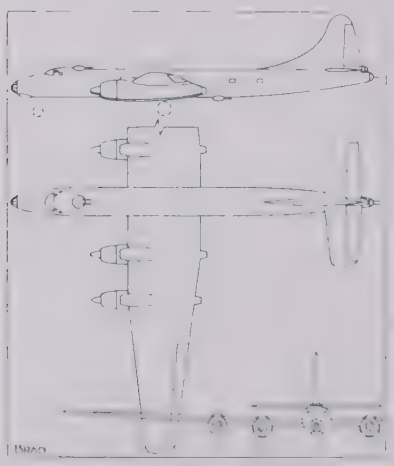
Andrei Tupolev still holds an important place in the Russian aeronautical field. At 66 years of age he is apparently still the active head of an important design bureau; in March,1952, Tupolev and 13 co-workers were awarded a Stalin Prize of 150,000 roubles for "new work" in aircraft construction.

A Lieutenant-General of the Aviation Engineering Corps., a Hero of Socialist Labour, and a holder of the Order of Lenin, Tupolev is one of the founders of the Soviet Aviation industry. His first design the ANT-1 appeared in 1922 and since then he has been responsible for a wide variety of aircraft. His only major design during the last war, however, was the TU-2, for which he was awarded a "Stalin Prize" in 1943.

Many examples of the TU-2 and TU-4 and some TU-6 reconnaissance-bombers are still in wide-spread service.

A new twin-jet light bomber, in service with some Soviet Navy units, is attributed to Tupolev.

The latest design with which Tupolev has been associated is a four-engined long-range bomber which has the provisional designation TUG-75(?). This aircraft had been previously referred to as the Type 31. A brief description follows.



The TUG-75 (?) (Provisional).

THE TUG-75 (?).

This long-range bomber was briefly but somewhat inaccurately referred to in the previous volume as the Type 31. It is now known to be, in the production form at least, a four-engined straight-wing bomber. The prototype of the present form had four Junkers Jumo compression-ignition engines.

TYPE.—Four-engined Long-range Strategic Bomber.

WINGS.—Cantilever monoplane type, derived from that of the TU-4 and, in turn, the Boeing B-29.

FUSELAGE.—Circular section all-metal structure, with crew compartments probably pressurised.

TAIL UNIT.—Of normal design, with large fin fairing.

LANDING GEAR.—Nose-wheel retractable type, with main wheels housed in outer nacelles.

POWER PLANT.—Four Junkers Jumo 022 turboprop engines, each developing 3,000 s.h.p. plus 2,250 lb. (1,020 kg.) residual thrust. Contra-rotating airscrews.

ACCOMMODATION.—Crew positions in nose, amidships and tail.

ARMAMENT AND EQUIPMENT.—Dorsal, ventral and tail gun turrets, and possibly lateral gun positions. Radome forward of nose-wheel.

DIMENSIONS (Approx.).—
Span 56.4 m. (185 ft.).
Length 44.25 m. (145 ft.).

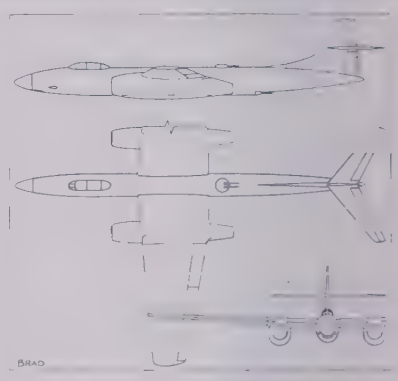
WEIGHTS.—
Loaded weight approx. 95,000 kg. (210,000 lb.).

PERFORMANCE (Approx.).—
Max. speed 670 km.h. (415 m.p.h.) at 9,150 m. (30,000 ft.).
Range 12,360 km. (7,650 miles).

THE TU-12 (?).

This aircraft, which is believed to have gone into service in 1951, is a twin-jet straight-wing swept tail light assault bomber which is intended for naval use. It is powered by two VK-1 turbojet engines (2,700 kg.=5,960 lb. s.t. each). Armament consists of two tail guns, and there are probably two fixed forward-firing guns in the nose. This aircraft may be adaptable to carry torpedoes. There is a ventral radome under the fuselage in the region of the crew compartment.

DIMENSIONS (Approx.).
Span 25.3 m. (83 ft.).



The TU-12 (?) (Provisional).

Length 24.4 m. (80 ft.).

WEIGHTS AND PERFORMANCE.—
No data available.

THE TUPOLEV TU-6.

The TU-6 is a high-altitude reconnaissance development of the TU-2, which it resembles in basic layout. It has, however, wings of greater span (approx. 21.75 m.=71 ft.) and may have a different power-plant. Accommodation and equipment will also differ. No further details of this aircraft are available.

THE TU-4 BOMBER.

Tupolev was responsible for the analysis and re-design for Russian production of



The TU-4, the Russian-built B-29 Superfortress Bomber.

the Boeing B-29 Superfortress, three specimens of which were forced to land near Vladivostock in 1944, in what was then Allied territory. The crews were interned and the aircraft impounded for Tupolev and his technical comrades to begin their remarkable task of reproduction.

The TU-4 is an oriental copy of the B-29. It is powered with four Russian copies of the Wright R-3350 engine, which drive Russian-made Hamilton-Standard Hydromatic airscrews. Russian guns, however, have been substituted for the American armament in the Russian version of the B-29's complex remotely-controlled gunnery system. There is little doubt that Tupolev has skillfully met the performance of the American B-29.

THE TU-4 (?) TRANSPORT.

In 1947 a prototype civil transport, aeroplane, which made use of the wings, power-plant, landing-gear and tail-unit of the TU-4 (B-29), was tested in the U.S.S.R. It has been described and illustrated (as the TU-70) in previous editions of "All the World's Aircraft."

In 1951 a military transport based on the TU-4 and the earlier civil prototype appeared, examples having been reported from Germany. Few precise details of this aircraft are known, but there appear to be large paratroop doors in the underside of the fuselage, one located forward and one aft of the wings.

THE TU-2.

TYPE.—Twin-engined Bomber and Attack monoplane.

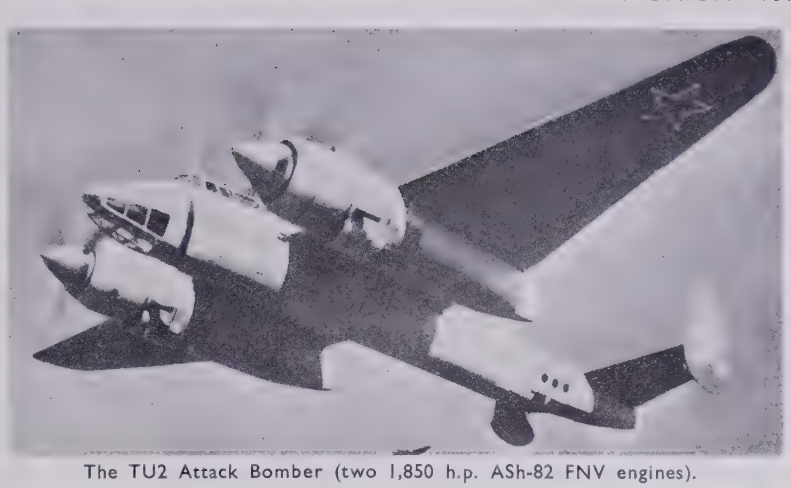
WINGS.—Mid-wing cantilever monoplane. Construction all-metal with metal stressed-skin covering. Two-piece ailerons on each wing, with split trailing-edge flaps between ailerons and nacelles and nacelles and fuselage.

FUSELAGE. — Oval, all-metal monocoque structure, with stressed skin covering.

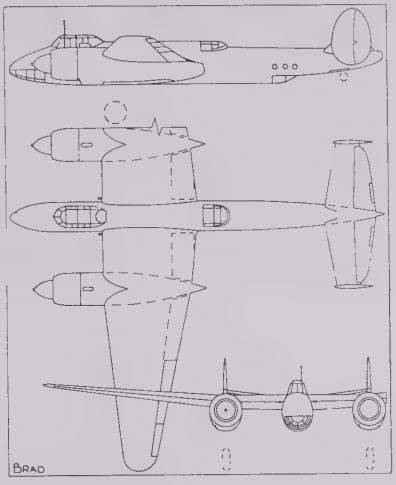
TAIL UNIT.—Cantilever monoplane type. with dihedral on tailplane and out-rigged oval fins and rudders. All-metal construction. Trim tabs in all movable surfaces.

POWER PLANT.—Two 1,850 h.p. ASh-82 FNV fourteen-cylinder radial air-cooled engines driving three-blade metal variable-pitch airscrews. Two fuel tanks in each wing, one inboard and one outboard of engine nacelle. Total capacity 2,800 litres (615 Imp. gallons).

LANDING GEAR.—Retractable tail-wheel type. Main wheels retract backwards into engine nacelles and tail-wheel retracts backwards into fuselage.



The TU2 Attack Bomber (two 1,850 h.p. ASh-82 FNV engines).



The TU-2 Attack-Bomber

ACCOMMODATION.—Crew of four, comprising pilot and radio-operator/gunner seated back-to-back in cockpit, rear dorsal gunner and rear ventral gunner. Radio operator moves down to bomb aiming panel in nose when necessary.

ARMAMENT AND EQUIPMENT.—Two fixed forward-firing 20 mm. ShVAK cannon one in each wing root, 200 r.p.g. One rearward-firing movable 12.7 mm. Beresin machine-gun behind pilot, and one rearward firing in dorsal position, 250 r.p.g. One rearward-firing movable 12.7 mm. Beresin machine-gun in ventral position, 250 r.p.g. Bomb-bay in fuselage, normal bomb load 1,500 kg. (3,300 lb.), max. bomb load 2,270 kg. (5,000 lb.).

DIMENSIONS.—
Span 18.86 m. (61 ft. 0 in.).
Length 13.8 m. (45 ft. 3 in.).

WEIGHTS.—
Empty weight 8,273 kg. (18,240 lb.).
Normal all-up weight 10,583 kg. (23,335 lb.).
Max. loaded weight 12,800 kg. (28,224 lb.).

PERFORMANCE.—
Max. speed approx. 560 km.h. (345 m.p.h.) at 5,800 m. (19,000 ft.).
Time to climb to 5,480 m. (18,000 ft.) 9.5 min.
Ceiling 10,980 m. (36,000 ft.).
Max. range with 1,500 kg. (3,300 lb.) bomb load 2,500 km. (1,550 miles).
Range with 2,270 kg. (5,000 lb.) bomb load 1,400 km. (880 miles).

YAKOVLEV

ALEKSANDIR SERGEIOVICH YAKOVLEV.

Yakovlev has shown himself, by his products, to be of the same order of versatility as A. N. Tupolev. He has gradually developed his designs from the earliest days, when he produced sailplanes and light sportsplanes, through the trainer period and into the times when his famous piston-engined fighters made the largest contribution to Russian fighter strength. Latest developments of the YaK-9 are still in service with the Soviet Air Fleet and for a period in 1950 formed part of the air arm of the Korean People's Democratic Republic. Poland has a number of YaK-9P's in service.

Of the many other important Yakovlev aeroplanes, the YaK-14 has been modified from its original form and began to replace the PO-2 in 1949.

The YaK-11 trainer is in use by the Soviet Air Fleet and also by aviation clubs. The F.A.I. has homologated two records for this type. In August, 1950 Ya. D. Forostenko flew a YaK-11 with take-off weight of 2,213 kg. (4,868 lb.) at an average speed of 441 km.h. (273.86 m.p.h.) over 500 km. (310.5 miles), and in September, 1950, Vladimir Markov flew a YaK-11 over 100 km. (62.1 miles) at an average speed of 479 km.h. (297.46 m.p.h.).

THE YaK-18.

TYPE.—Two-seat Training monoplane.

WINGS.—Low-wing cantilever monoplane. Metal structure, leading-edge stiffened with aluminium sheet, and fabric covering. Large ailerons in outer panels; one-piece flap across centre-section at trailing-edge.

FUSELAGE.—Metal basic structure, with built-up formers and longerons. Metal covering back to rear cockpit, fabric covering on rear section.

TAIL UNIT.—Braced monoplane type with single fin and rudder. Fabric covering on all surfaces. Trim tab in rudder.

LANDING GEAR.— Retractable tail-wheel type. Wheels retract hydraulically backwards into wells in wing, about half of wheel remaining exposed. Hydraulic retraction. Fixed castoring tail-wheel.

POWER PLANT.—One 160 b.h.p. M11-RF five-cylinder air-cooled single-row radial engine in "helmeted" cowl. VISh(a) two-blade variable pitch metal airscrew with large spinner. Diameter 2 m. (6 ft. 6½ in.).

ACCOMMODATION.—Two seats in tandem beneath continuous canopy raised above top-line of fuselage.

EQUIPMENT.—Includes blind-flying instruments, radio receiver and transmitter.

DIMENSIONS.—
Span 10.6 m. (34 ft. 9 in.).
Length 8.03 m. (26 ft. 4½ in.).
Height 3.15 m. (10 ft. 4 in.).
Wing area 17 m.² (183 sq. ft.).

WEIGHTS AND LOADINGS.—
Weight empty 755 kg. (1,665 lb.).
Weight loaded 1,070 kg. (2,360 lb.).
Wing loading 63 kg./m.² (12.9 lb./sq. ft.).
Power loading 6.7 kg./c.v. (14.8 lb./b.h.p.).

PERFORMANCE.—
Max. speed 257 km.h. (159 m.p.h.).
Cruising speed 215 km.h. (133.5 m.p.h.).
Landing speed 85 km.h. (53 m.p.h.).
Ceiling 5,000 m. (16,400 ft.).
Range 900 km. (560 miles).
Take-off distance 290 m. (950 ft.).
Landing distance 247 m. (810 ft.).

THE YaK-16.

This medium-size passenger transport, freighter and military transport made its first appearance outside Russia at the 1948 Poznan Trade Fair in Poland, and



The YaK-18 Trainer (160 h.p. M11-RF engine).



The YaK-16 Feeder-line Transport (two 750 h.p. ASh-21 engines).

was subsequently displayed in Czechoslovakia, Finland, Hungary and Rumania. The YaK-16 is in service with Aeroflot on some of the shorter services.

TYPE. — Twin-engined medium feeder-line transport.

WINGS.—Low-wing cantilever monoplane. Metal construction and stressed skin covering. Ailerons and split trailing-edge flaps in outer wing panels.

FUSELAGE. — Metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type with single fin and rudder. Metal construction and metal covering.

LANDING GEAR.—Retractable tail-wheel type. Cantilever oleo shock-absorbers. When gear is retracted, about half of each wheel remains exposed. Fixed sprung tail-wheel.

POWER PLANT.—Two ASh-21 seven-cylinder air-cooled single-row radial engines. Take-off power 750 b.h.p at 2,300 r.p.m. at sea level; max. continuous cruising rating 680 b.h.p. at 1,900 r.p.m. VISh(a) two-blade metal controllable-pitch airscrews with large spinners; three-blade airscrews may be fitted. Fuel capacity 1,800 litres (395 Imp. gallons) in wing tanks. Oil, 70 litres (15 Imp. gallons) in tank in centre section.

ACCOMMODATION.—Crew of two or three, and seats for ten passengers in main cabin. Five single seats down each side of central aisle. Entry door in port side at rear of cabin; small toilet compartment at rear of cabin opposite entry door. Freight compartment in rear of fuselage with access through door from main cabin.

DIMENSIONS.—
Span 20 m. (65 ft. 7 in.).
Length 14.5 m. (47 ft. 6 in.).
Height 3.6 m. (12 ft.).

WEIGHTS.—
Weight empty 5,000-5,200 kg. (11,000-11,450 lb.).
Max. payload 1,360 kg. (3,000 lb.).
Weight loaded 6,400 kg. (14,100 lb.).

PERFORMANCE.—
Max. speed 310 km.h. (190 m.p.h.).
Cruising speed at 1,700 m. (5,600 ft.) 290 km.h. (180 m.p.h.).
Landing speed 85 km.h. (53 m.p.h.).
Ceiling about 5,000 m. (16,400 ft.).
Single-engine ceiling 2,300 m. (7,550 ft.).
Optimum range 1,000 km. (620 miles).
Take-off run with 25 degree flaps 260 m. (855 ft.).

THE IMPROVED YaK-17.

TYPE.—Single-seat Interceptor Fighter.

WINGS.—Mid-wing cantilever monoplane. All-metal construction. Constant taper with blunt wing-tips.

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. Tailplane now has blunted or squared tips.

LANDING GEAR.—Retractable tricycle type, main wheels raises inwards into wings and nose wheel backwards with fairing under forward part of fuselage.

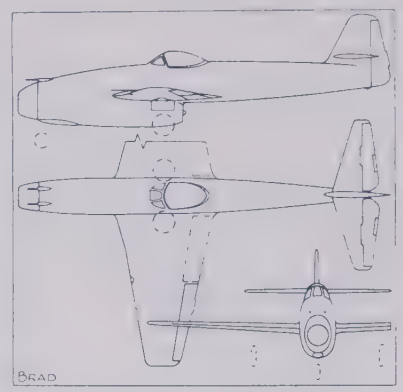
POWER PLANT.—One RD-500 (?) centrifugal-flow turbojet engine, believed to be developed from the Rolls-Royce Derwent, in lower extension of forward fuselage with jet pipe exit in line with trailing-edge of wing.

ACCOMMODATION.—Single-cockpit with sliding canopy above wings.

ARMAMENT.—Two cannon above nose air-intake.

DIMENSIONS (Approx.).—
Span 10.0 m. (32 ft. 10 in.).

WEIGHTS AND PERFORMANCE.—
No data available.



The improved YaK-17 Fighter.

THE U-YaK-17.

The U-YaK-17 two-seat conversion trainer is a version of the earlier modified YaK-17 with nose-wheel landing-gear and a Russian-built Jumo 004B axial-flow turbojet power-unit. The instructor and pupil are in tandem cockpits beneath a continuous canopy. The armament is probably deleted.

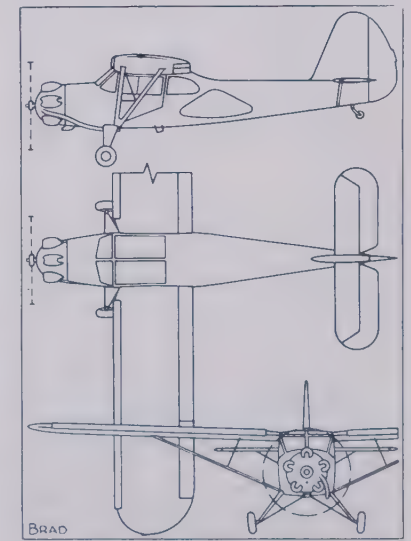
DIMENSIONS (Approx.).—
Span 9.15 m. (30 ft.).
Length 8.54 m. (28 ft.).

PERFORMANCE.—
Max. speed about 815 km.h. (506 m.p.h.).
Cruising speed 595 km.h. (368 m.p.h.) at 9,150 m. (30,000 ft.).
Climb to 9,150 m. (30,000 ft.) 13.5 min.
Service ceiling 12,200 m. (40,000 ft.).
Range 645 km. (400 miles).

THE YaK-14.

The production YaK-14 differs from the original 1944 version which has been described in previous editions of this Annual in having a stepped-down rear fuselage line and increased fin and rudder area. The present YaK-14 can be used as an ambulance, there being a large hatch in the rear fuselage for stretcher loading.

The new model began to replace the PO-2 trainer in 1949. Insufficient data is available to permit a description to be prepared.

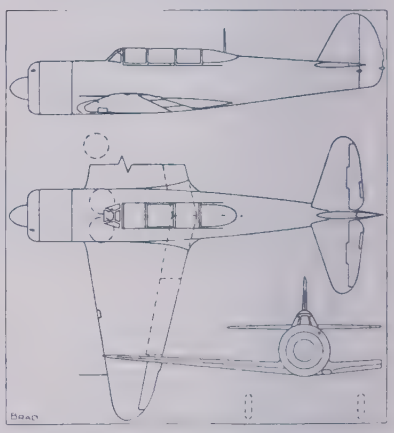


The YaK-14 Light Transport.

THE YaK-11.

TYPE.—Two-seat intermediate and advanced trainer.

WINGS.—Low-wing cantilever monoplane. Sharp straight taper on leading and trailing-edges to rounded tips. Dihedral from roots. Small ailerons, and split flaps extending along trailing-edge from ailerons to meet at fuselage centre.



The YaK-11 Advanced Trainer.

FUSELAGE.—Circular section forward, tapering in plan back to tail unit.

TAIL UNIT.—Cantilever monoplane type with single fin and rudder. Sharp straight taper on tailplane leading-edge, slight taper on trailing-edge, with rounded tips and cut-out for rudder movement. Inset elevators, with trim-tabs. Fin has straight leading-edge and rounded top; trailing-edge of rudder is rounded.

LANDING GEAR.—Retractable tail-wheel type. Main legs and wheels retract inwards to lie flush in wing beneath fuselage. Fixed tail-wheel.

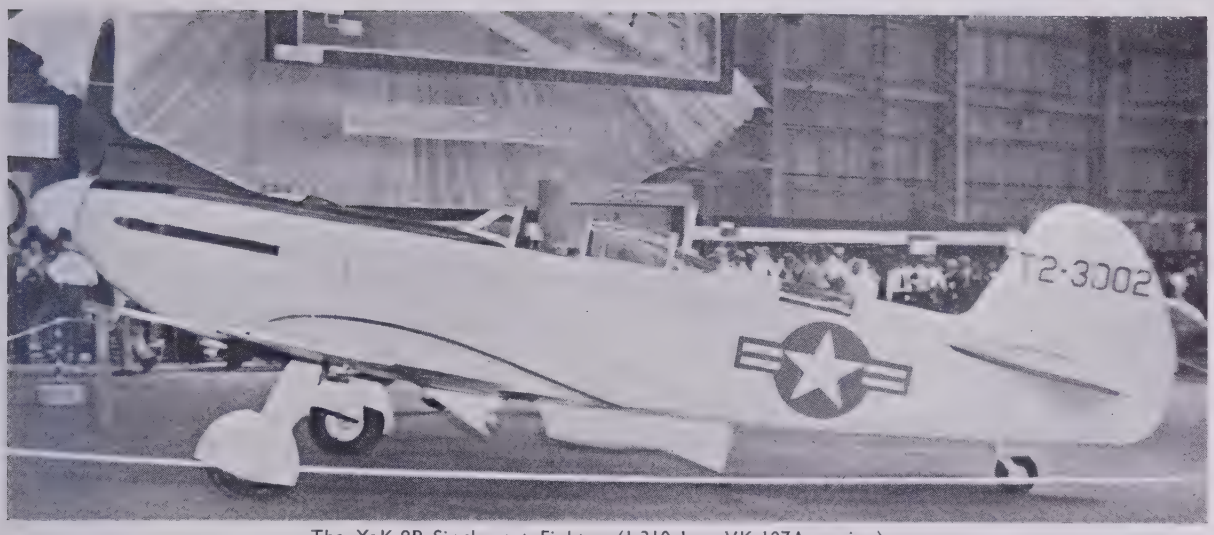
POWER PLANT.—One ASh-21 seven-cylinder air-cooled single-row radial engine, using direct fuel injection. Take-off power 750 b.h.p. at 2,300 r.p.m. at sea level. Max. continuous cruising rating 680 b.h.p. at 1,900 r.p.m. VISh(a) two-blade metal controllable-pitch airscrew.

ACCOMMODATION.—Two seats in tandem beneath long "glass-house" enclosure raised above top line of fuselage.

EQUIPMENT.—Includes full radio receiver and transmitter sets.

DIMENSIONS.—
Span 9.3 m. (30 ft. 6 in.).
Length about 8.47 m. (27 ft. 9 in.).

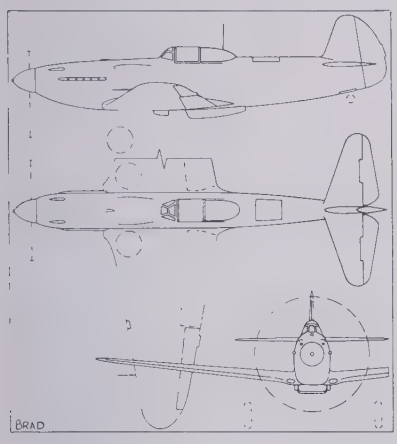
WEIGHTS AND PERFORMANCE.—
No data available.



The YaK-9P Single-seat Fighter (1,310 h.p. VK-107A engine).

THE YaK-9P.

TYPE.—Single-seat Interceptor Fighter made at Factory 286 at Kamensk/Uralsk.
WINGS.—Low-wing cantilever monoplane. Two-spar all-metal structure. Pneumatically-operated trailing-edge flaps. Wing area 16.5 m.² (177.5 sq. ft.).
FUSELAGE.—Welded steel tube structure.

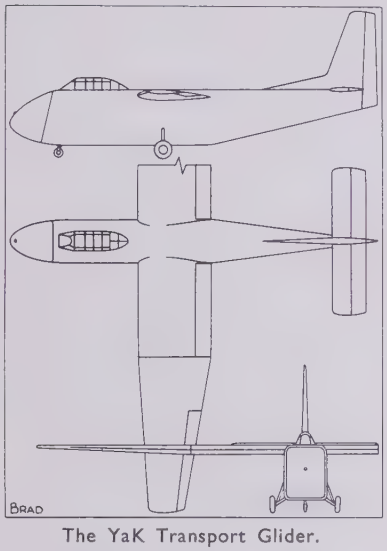


The YaK-9P Single-seat Fighter.

TAIL UNIT.—Cantilever monoplane type.
LANDING GEAR.—Retractable tail-wheel type. Pneumatically-operated.
POWER PLANT.—One 1,310 h.p. VK-107A twelve-cylinder Vee liquid-cooled engine with two-speed blower. Engine made at Factory No. 26, at Ufa. Coolant radiator beneath fuselage.
ACCOMMODATION.—Enclosed cockpit with bullet proof windscreen and armour plate protection.
ARMAMENT.—One 20 mm. cannon (100 rounds) in cylinder Vee and firing through airscrew boss and two 12.7 mm. machine-guns (250 rounds each) in cowling above engine.
DIMENSIONS.—
Span 9.45 m. (30 ft. 11 in.).
Length 8.5 m. (27 ft. 10 in.).
WEIGHT.—
Weight loaded 3,175 kg. (6,985 lb.).
PERFORMANCE.—
Max. speed 600 km.h. (373 m.p.h.) at 4,000 m. (13,120 ft.).
Cruising speed 328 km.h. (204 m.p.h.) at 2,500 m. (8,200 ft.).
Range 815 km. (505 miles).

THE YaK TRANSPORT GLIDER.

At the Aviation Day Display in 1949 a large number of large transport gliders somewhat similar to the British Hamilcar and attributed to Yakovlev appeared over Tushino towed by IL-12's. Apart from the fact that this glider has a span of about 26 m. (85 ft.) and a length of about 18 m. (60 ft.) nothing further is known of its characteristics.



The YaK Transport Glider.

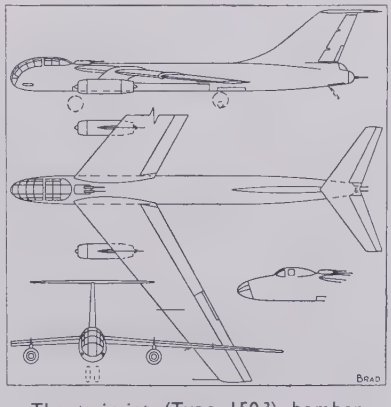
MISCELLANEOUS UNIDENTIFIED AIRCRAFT.

Hereafter are listed a number of Russian military aircraft which are known to exist but concerning which insufficient information is available to enable them to be identified.

1. About four prototypes or small production batches of Russian jet fighters were reported in 1949, all very similar and as yet not clearly differentiated. One of these undoubtedly gave rise to a 1951 fighter exhibited at Tushino. This fighter is perhaps best described as a swept-wing development of the MIG-9, for it seems to have the characteristic twin belly-mounted jet units of this early fighter, with swept-wing and tail surfaces. A radome is installed above the widened nose air intake. No other reliable details are available.

2. Reports from Germany in the summer of 1951 told of the appearance there in small numbers of a new Russian jet fighter. It may also have appeared at Tushino. From information so far available this aircraft appears to be very similar to the Focke-Wulf Ta 183, the last of Professor Kurt Tank's fighter designs which was under development at the time of the German capitulation. It is stated to be rather faster than the MIG-15 and may possess apparatus for rocket boosting but reliable details are not available.

3. It is now definitely established that small rocket-propelled interceptor has been developed for target-defence duties in Russia, and is now being supplied in some numbers to the VVS. Its identity is at present not known.



The twin-jet (Type 150?) bomber referred to in paragraph 4 alongside.

It stems in conception from the Me 163 or 8-263 and perhaps more immediately from Russian post-war prototypes related to the DFS 346. This unidentified Russian interceptor is a single-seat mid-wing monoplane of conventional layout, powered by a development of the Walther HWK 559, having twin effluxes under the rudder. The landing-gear is of the nose-wheel type.

4. A twin-jet high-speed tactical bomber with 35° swept wings and tail and a tandem-wheel landing-gear (plus outrigged stablising wheels under wings) has been reported. It is said to be powered by two axial-flow turbojet engines (5,000 kg. = 11,000 lb. s.t. each) of German origin and to be armed with two NS 23 mm. guns in a retractable dorsal turret and twin 23 mm. guns in a tail position. The significance of the designation Type 150, which has been applied to this aircraft is unknown.

SPAIN

A.I.S.A.

AERONAUTICA INDUSTRIAL S.A.

HEAD OFFICE: ALCALA 10, MADRID.
WORKS AND AERODROME: CARABANCHEL ALTO, MADRID
President: Sr. Conde de Mieres.
Chairman: D. Lázaro Ros España.
Director-General: D. Maximo Villanueva Jiménez.

This concern, with fully-equipped works and adjoining aerodrome at Carabanchel Alto (Madrid), has since 1923 been engaged in the manufacture, reconstruction and repair of aircraft of wood and mixed construction.

In 1943, three types were produced, the H.M.1 and H.M.5 trainers and the H.M.9 glider-tug. In 1945 the H.M.2 was completed and in 1947 prototypes of the H.M.3 seaplane and the H.M.7 four-seat cabin monoplane were built. All these aircraft, which have been illustrated and described in previous editions of "All the World's Aircraft," were designed by the Instituto Nacional de Técnica Aeronautica (INTA) and were built by the Aeronautica Industrial S.A. (AISA) in their works at Carabanchel Alto, near Madrid.

In 1946 AISA collaborated with Iberavia S.A. in the construction of various types of aircraft designed by that company, including the I-11 and I-115.

Recently the Aircraft Department of Iberavia S.A. was taken over by Aeronautica Industrial S.A. and it is now engaged in the development of several new aircraft. These include the I-18, which will be the company's first all-metal aircraft; a new version of the I-11; and two types of helicopters, the IH-52 of conventional design and the IH-51 which will be jet-driven.

AISA is continuing production of the I-11 and the I-115, both of which are described hereafter.

THE A.I.S.A. I-115.

The first prototype I-115 flew for the first time on June 20, 1952. The aircraft is now going into production for the Spanish Air Force under the military designation E-6.

TYPE.—Two-seat Primary or single-seat Aerobatic Trainer.

WINGS.—Low-wing cantilever monoplane. NACA 23015/23009 wing section. Chord 1.96 m. (6 ft. 5 in.) at root, 0.98 m. (3 ft. 2 in.) at tip. Dihedral 6°. Incidence 3°. Single-piece two-spar all-wood structure with stressed plywood skin. Slotted flaps and differentially-operated ailerons have plywood frames and leading-edges and overall fabric covering. Ailerons droop when flaps lowered. Total area of flaps 1.59 m.² (17.1 sq. ft.). Total area of ailerons 1.19 m.² (12.8 sq. ft.). Gross wing area 14.0 m.² (150.6 sq. ft.).

FUSELAGE.—All-wood monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Structure and tab arrangements as for I-11. Areas: fin 0.65 m.² (6.9 sq. ft.), rudder 0.55 m.² (5.9 sq. ft.), tailplane 1.56 m.² (16.7 sq. ft.), elevators 1.02 m.² (10.9 sq. ft.). Span of tailplane 3.2 m. (10 ft. 6 in.).

LANDING GEAR.—Fixed tail-wheel type. Oil/spring shock-absorbers. Hydraulic wheel brakes. Tail-wheel is linked to rudder-bar but may be disconnected at will by pilot.

POWER PLANT.—One 150 h.p. E.N.M.A. Tigre G-IV-B four-cylinder in-line inverted air-cooled engine. P8 two-blade metal airscrew with pitch adjustable on ground. Two fuel tanks in wings. Total fuel capacity 135 litres (30 Imp. gallons).

ACCOMMODATION.—Tandem cockpits under continuous canopy with sliding section over each cockpit. Complete dual controls and instrumentation. Equipment includes Iberabia ITR 6 radio transmitter/receiver and Marconi artificial horizon. Small baggage compartment behind rear seat accessible from outside.

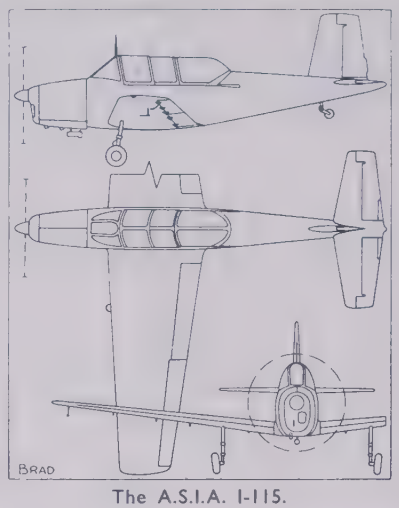
DIMENSIONS.—
Span 9.54 m. (31 ft. 3 in.).
Length 7.35 m. (24 ft. 1 in.).
Height 2.10 m. (6 ft. 10 in.).

WEIGHTS AND LOADINGS (Two-seater).—
Weight empty 612 kg. (1,346 lb.).
Weight loaded 900 kg. (1,980 lb.).
Wing loading 64.3 kg./m.² (13.18 lb./sq. ft.).
POWER LOADING 5.06 kg./h.p. (11.13 lb./h.p.).

PERFORMANCE (two-seater, fully loaded).—
Max. speed 240 km.h. (149 m.p.h.).
Cruising speed 204 km.h. (126.6 m.p.h.).
Landing speed with flaps 81.5 km.h. (50.6 m.p.h.).
Initial rate of climb 225 m./min. (686 ft./min.).
Service ceiling 4,400 m. (14,430 ft.).
Take-off distance to 15 m. (50 ft.) 380 m. (415 yds.).
Landing distance from 15 m. (50 ft.) 350 m. (382 yds.).
Duration (70% power) 3½ hours.



The A.I.S.A. I-115 Two-seat Trainer (150 h.p. E.N.M.A. Tigre G-IV-B engine).



The A.S.I.A. I-115.

THE A.I.S.A. I-11 PEQUE.

TYPE.—Two-seat Light Touring or Elementary Training monoplane.

WINGS.—Low-wing cantilever monoplane. NACA 23015/23009 wing section. Root chord 1.74 m. (5 ft. 8 in.), tip chord 1.14 m. (3 ft. 9 in.). Dihedral 7°. Incidence 3°. Two-spar wood structure with plywood skin. Differentially-operated ailerons have wood frames and leading-edge and overall fabric covering. Total aileron area 1.39 m.² (14.9 sq. ft.). Wing area 13.5 m.² (145.2 sq. ft.).

FUSELAGE.—All-wood monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Fixed surfaces have two spars and plywood skin. Movable surfaces have wood frames and leading-edges a fabric covering. Trim-tabs in elevators. Rudder tab is adjustable on ground only. Areas: fin 0.59 m.² (6.3 sq. ft.), rudder 0.36 m.² (3.8 sq. ft.), tailplane 1.35 m.² (14.5 sq. ft.), elevators 0.74 m.² (7.9 sq. ft.). Span of tailplane 2.9 m. (9 ft. 6 in.).

LANDING GEAR.—Fixed tricycle type. Oil/spring shock-absorbers. Steerable nose-wheel. Hydraulic brakes.

POWER PLANT.—One 90 h.p. Continental C90-12F four-cylinder horizontally-opposed air-cooled engine driving a two-blade Aeromatic or fixed-pitch wood airscrew. Total fuel capacity 80 litres (17.6 Imp. gallons).

ACCOMMODATION.—Two side-by-side seats with dual controls under "blister" type canopy. Baggage space aft of seats.

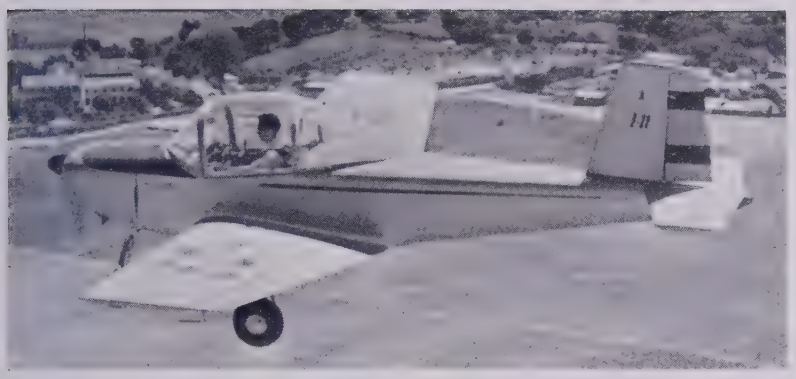
DIMENSIONS.—
Span 9.36 m. (30 ft. 7 in.).
Length 6.40 m. (21 ft.).
Height 2.39 m. (7 ft. 10 in.).



The A.I.S.A. I-115 Two-seat Trainer (150 h.p. E.N.M.A. Tigre G-IV-B engine).

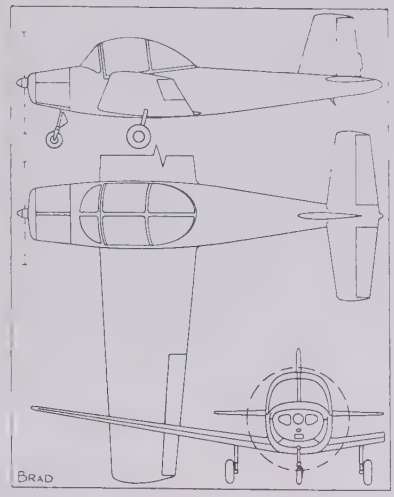


The A.I.S.A. I-11 Peque (90 h.p. Continental C90 engine).



The A.I.S.A. I-11 Peque (90 h.p. Continental C90 engine).

WEIGHTS AND LOADINGS.—
Weight empty 460 kg. (1,012 lb.).
Weight loaded 700 kg. (1,540 lb.).
Wing loading 51.8 kg./m.² (10.6 lb./sq. ft.).
Power loading 8.2 kg./h.p. (18.0 lb./h.p.).
PERFORMANCE.—
Max. speed 196 km.h. (122 m.p.h.).
Cruising speed (70% power) 174 km.h. (108 m.p.h.).
Min. speed 86 km.h. (53.4 m.p.h.).
Initial rate of climb 195 m./min. (640 ft./min.).
Service ceiling 4,000 m. (13,120 ft.).
Range 700 km. (435 miles).



The A.I.S.A. I-11 Peque.

C.A.S.A.

CONSTRUCCIONES AERONAUTICAS S.A.

HEAD OFFICE: CALLE REY FRANCISCO No. 4, MADRID.
WORKS: MADRID, GETAFE, SEVILLE AND CADIZ.
President: Don Victor Chavarri Anduiza.
Vice-President: Don José Lacalle Larraga.
Counsellor-Deputy: Don José Ortíz Echagüe.
Managing Director: Don Francisco Díaz Iboléon.
Consulting Engineer: Don Francisco Lozano Aguirre.
Engineer in charge of Projects: Don Pedro Huarte-Medicoa Larraga.
Engineer in charge of Production: Don Eugenio Aguirre Castillo.
Engineer in charge of Administration: Don Emilio de la Guardia Ruiz.

This important concern has four factories wherein are built various types of all-metal military aircraft of national and foreign design for the Spanish Air Force.

In 1949, CASA completed the first twin-engined aircraft of Spanish design, the CASA-201. This aircraft is now in production.

Flight tests have been completed with the prototype of a second twin-engined aircraft of the firm's own design, the CASA-202, which is now in production.

The company now has under construction a twin-engined 30/38 passenger airliner known as the CASA-207. This aircraft is expected to fly in 1954.

THE CASA-201 ALCOTAN.

The CASA-201, which flew for the first time in February, 1949, was the first twin-engined aircraft of original Spanish design and construction.

Several versions of the CASA-201 now being developed, have the following designations and functions:—

201-A. Passenger version. Two Armstrong Siddeley Cheetah 27 engines.

201B. Passenger version Two E.N.M.A. Sirio-VII-A engines.

201-D. Navigation, Radio, Multi-engine and Blind-flying training aircraft. Two Armstrong Siddeley Cheetah 27 engines.

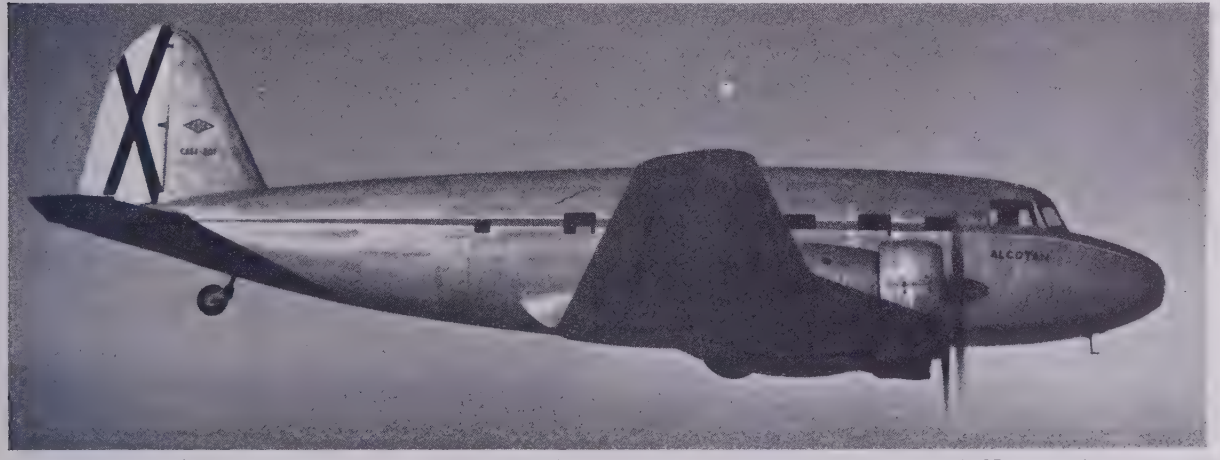
201-E. Bombing and Photographic Training aircraft. Two Armstrong Siddeley Cheetah 27 engines.

201-F and G. Same as 201-D and E, but with two E.N.M.A. Sirio-VII-A engines.

TYPE.—Twin-engined Light Transport.
WINGS.—Low-wing cantilever monoplane. Wing in three sections comprising centre-section and two tapering outer sections set at 6° dihedral. All-metal two-spar structure. Hydraulically-operated flaps inboard of ailerons, the latter being interconnected with the flaps and arranged to droop to augment flap area for landing. Wing area 41.80 m.² (450 sq. ft.).
FUSELAGE.—All-metal semi-monocoque structure.
TAIL UNIT.—Cantilever monoplane type. All-metal tailplane and fin, metal framed fabric-covered rudder and elevators.
LANDING GEAR.—Retractable tail-wheel type. Hydraulic operation.
POWER PLANT.—Two Armstrong Siddeley Cheetah 27 seven-cylinder radial air-cooled engines, each with a normal rated output of 385 h.p. and with 475 h.p. available for take-off, or two E.N.M.A. Sirio-VIIA seven-cylinder radial engines, each with a normal rated output of 440 h.p. and with 500 h.p. available for take-off. Fuel tanks in wings.
ACCOMMODATION.—Crew of two and ten passengers. Cabin heating. Night-flying equipment.
DIMENSIONS.—
Span 18.40 m. (60 ft. 4 in.).
Length 13.80 m. (45 ft. 3 in.).
Height 3.85 m. (12 ft. 8 in.).
WEIGHTS AND LOADINGS (Cheetah engines).—
Weight empty 3,560 kg. (7,830 lb.).
Weight loaded 5,100 kg. (11,230 lb.).
Wing loading 122 kg./m.² (25 lb./sq. ft.).
Power loading 5.37 kg./h.p. (11.8 lb./h.p.).
WEIGHTS AND LOADINGS (Sirio engines).—
Weight empty 3,600 kg. (7,920 lb.).
Weight loaded 5,500 kg. (12,100 lb.).
Wing loading 131 kg./m.² (26.8 lb./sq. ft.).
Power loading 6.11 kg./h.p. (13.5 lb./h.p.).
PERFORMANCE (Cheetah engines).—
Max. speed 325 km.h. (203 m.p.h.).
Landing speed 112 km.h. (70 m.p.h.).
Service ceiling 5,600 m. (18,370 ft.).
Range 1,000 km. (621 miles).
Duration 4 hours.
PERFORMANCE (Sirio engines).—
Max. speed 350 km.h. (219 m.p.h.).
Landing speed 117 km.h. (73 m.p.h.).
Service ceiling 6,100 m. (20,000 ft.).
Range 1,000 km. (621 miles).
Duration 4 hours.

THE CASA-202 HALCÓN.

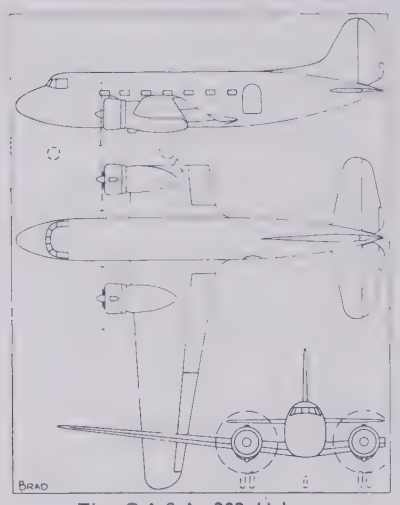
TYPE.—Twin-engined Transport.
WINGS.—Low-wing cantilever monoplane. Wing section NACA 23018 at root, 23009 at tip. Aspect ratio 8.11. Dihedral 6°. Chord 4.1 m. (13 ft. 5 in.) at root, 1.3 m. (4 ft. 3 in.) at tip. All-metal two-spar structure. Metal framed fabric covered ailerons. Total area of ailerons 44 m.² (47.3 sq. ft.). All-metal trailing-edge flaps. Total area of flaps 6.8 m.² (73.2 sq. ft.). Gross wing area 57.40 m.² (617.6 sq. ft.).
FUSELAGE.—All-metal semi-monocoque structure.
TAIL UNIT.—Cantilever monoplane type. All-metal fin and tail-plane, metal-framed fabric-covered rudder and elevators. Areas:



The C.A.S.A. 201 Alcotan Light Transport (two 475 h.p. Armstrong Siddeley Cheetah 27 engines).



The Casa-202 Halcon Airliner (two 775 h.p. E.N.M.A. Beta engines).



The C.A.S.A. 202 Halcon.

fin 2.8 m.² (30.1 sq. ft.), rudder 2.3 m.² (24.7 sq. ft.), elevators (total) 5.3 m.² (57 sq. ft.), tailplane 6.5 m.² (69.9 sq. ft.).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic operation. Oleo shock-absorbers. Dual main wheels. Hydraulic brakes. Track 5.172 m. (16 ft. 11½ in.). Wheelbase 4.90 m. (16 ft. 1 in.).

POWER PLANT.—Two E.N.M.A. Beta 9C-29-750 nine-cylinder radial air-cooled engines, each with normal rating of 750 h.p. and with 775 h.p. available for take-off. Fuel tanks in wings, two in centre-section of 530 litres (116 Imp. gallons) each, and two in outer wings of 540 litres (119 Imp. gals.) each. Total fuel capacity 2,140 litres (470 Imp. gals.).

ACCOMMODATION.—Crew of three and fourteen passengers. Cabin heated and air-conditioned. Night flying equipment.

DIMENSIONS.—
Span 21.58 m. (70 ft. 9 in.).
Length 15.80 m. (51 ft. 10 in.).
Height 4.25 m. (13 ft. 11 in.).
Wing area 57.40 m.² (617.6 sq. ft.).

WEIGHTS AND LOADINGS.—
Weight empty 4,660 kg. (10,250 lb.).
Max. disposable load 2,840 kg. (6,250 lb.).
Weight loaded 7,500 kg. (16,500 lb.).
Wing loading 130.66 kg./m.² (26.78 lb./sq. ft.).

PERFORMANCE.—
Max. speed at S/L. 310 km.h. (192.5 m.p.h.).
Max. speed at 2,840 m. (9,315 ft.) 345 km.h. (214 m.p.h.).
Cruising speed (70% power) 300 km.h. (186 m.p.h.).
Landing speed 117 km.h. (72.6 m.p.h.).
Service ceiling 7,550 m. (24,760 ft.).
Service ceiling on one engine 3,000 m. (9,840 ft.).

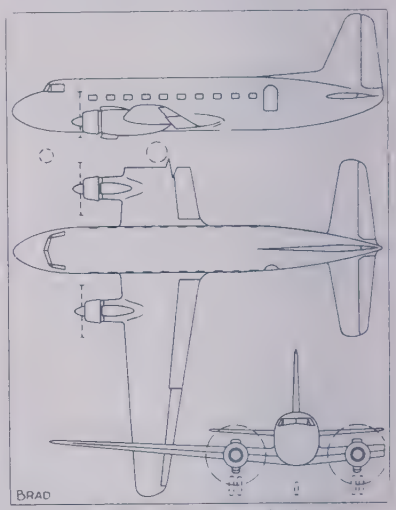
THE CASA-207 AZOR.

The CASA-207 will be a large twin-engined airliner with accommodation for 30-38 passengers. It will be powered by two Bristol Hercules 730 sleeve-valve radial air-cooled engines. The accompanying artist's impression and general arrangement drawing of the CASA-207 shows its external appearance. No structural details were available at the time of writing.

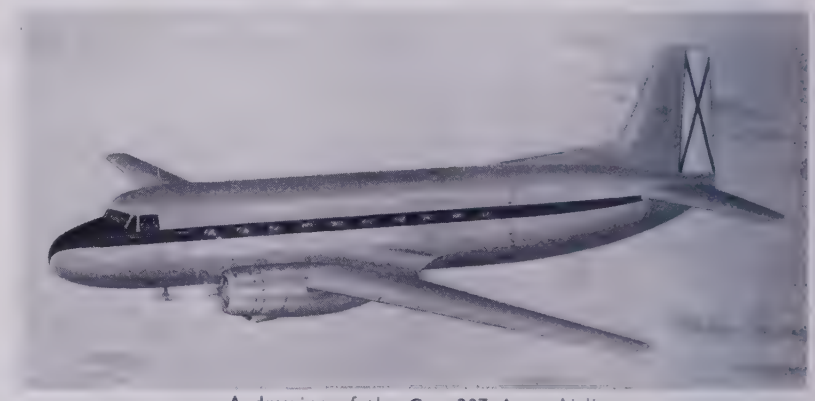
DIMENSIONS.—
Span 27.80 m. (91 ft. 1 in.).
Length 21.00 m. (69 ft. 0 in.).
Wing area 86.00 m.² (925 sq. ft.).

WEIGHTS (Designed).—
Weight empty 9,280 kg. (21,620 lb.).
Crew 320 kg. (705 lb.).
Passengers 2,316 kg. (5,100 lb.).
Fuel and oil 2,074 kg. (4,567 lb.).
Freight and baggage 470 kg. (1,050 lb.).
Weight loaded 14,460 kg. (33,042 lb.).

PERFORMANCE (Estimated).—
Max. speed at 1,525 m. (5,000 ft.) 420 km.h. (260 m.p.h.).
Cruising speed at 3,050 m. (10,000 ft.) 350 km.h. (218 m.p.h.).
Stalling speed (with flaps) 140 km.h. (87 m.p.h.).
Service ceiling 7,700 m. (25,250 ft.).
Range 1,750 km. (1,100 miles).



The Casa-207 Azor Airliner.



A drawing of the Casa-207 Azor Airliner.

HISPANO

LA HISPANO AVIACIÓN S.A.

HEAD OFFICE: AVENIDA DE JOSÉ ANTONIO No. 7. MADRID.

AIRCRAFT WORKS: SEVILLE.

The controlling interest in La Hispano Aviacion, S.A. is held by La Hispano Suiza S.A.

The company is in production with two types of aircraft, the HA-43, the HA-1109 and the HA-1110. The former is a two-seat monoplane suitable for the training of pilots and observers. The model now in production is the HA-43-D1. The HA-1109-K1L is a development of the Messerschmitt Me 109 with new power-plant and other changes meeting Spanish requirements. The HA-1110-K1L is a two-seat dual control trainer version of the HA-1109.

La Hispano Aviacion has under development prototypes of the HA-100-E1, HA-110-C1 and HA-120-R1. The HA-100-E1 will be a two-seat all-metal advanced training monoplane; the HA-110-C1 will be a derivative of the former with a different power-plant; and the HA-120-R1 will be a twin-jet two-seat conversion trainer.

LA HISPANO HA-43-D1.

TYPE.—Two-seat Advanced Trainer.

WINGS.—Low-wing cantilever monoplane NACA 230 Series wing section. Aspect ratio 6.13. Chord (mean) 1.734 m. (5 ft. 8¼ in.). Dihedral 6°. Incidence 1° 17'. All-wood structure with plywood covering. Hydraulically-operated flaps and statically and dynamically balanced ailerons. Flap and aileron controls interconnected so that ailerons droop when flaps are lowered. Gross wing area 16.3 m.² (175.4 sq. ft.).

FUSELAGE—Oval section with basic structure of welded chrome-molybdenum steel tubing and covering of duralumin sheet panels and fabric.

TAIL UNIT.—Braced monoplane type. Welded steel tube framework covered with fabric. Statically-balanced control surfaces with controllable trim-tabs. Areas: fin 0.386 m.² (4.15 sq. ft.), rudder 0.787 m.² (8.47 sq. ft.), tailplane 1.374 m.² (14.78 sq. ft.), elevators 1.256 m.² (13.51 sq. ft.). Tailplane span 3.30 m. (10 ft. 9¾ in.).

LANDING GEAR.—Retractable tail-wheel type. Hydraulic retraction. Hydraulic shock-absorbers. Messier wheels with medium-pressure tyres. Messier brakes. Track 3.046 m. (10 ft.).

POWER PLANT.—One 390 h.p. Armstrong Siddeley Cheetah 27 seven-cylinder radial air-cooled geared and supercharged engine driving a Rotol controllable-pitch airscrew with wood blades. Airscrew diameter 2.84 m. (9 ft. 4 in.) diameter. Fuel tanks

in fuselage and centre-section. Total fuel capacity 400 litres (88 Imp. gallons). Oil capacity 25 litres (6 Imp. gallons).

ACCOMMODATION.—Tandem cockpits under continuous canopy with separate sliding sections over cockpits. Dual controls.

EQUIPMENT.—Includes two Breda 7.7 mm. machine-guns in wings (200 r.p.g.) six rockets, three under each wing, radio, night-flying equipment, etc.

DIMENSIONS.—
Span 10.00 m. (32 ft. 10 in.).
Length 7.95 m. (26 ft. 2 in.).
Height 2.60 m. (8 ft. 6 in.).

WEIGHTS AND LOADINGS.—
Weight empty 1,504 kg. (3,309 lb.).
Disposable load 546 kg. (1,201 lb.).
Weight loaded 2,050 kg. (4,510 lb.).
Wing loading 126 kg./m.² (25.8 lb./sq. ft.)

PERFORMANCE.—
Max. speed 335 km.h. (208 m.p.h.).
Average cruising speed 295 km.h. (183 m.p.h.).
Stalling speed 128 km.h. (79.5 m.p.h.).
Stalling speed (flaps down) 118 km.h. (73 m.p.h.).
Rate of climb 480 m./min. (1,410 ft./min.).
Ceiling 6,000 m. (19,680 ft.).
Normal cruising range 1,200 km. (745 miles).
Normal duration 4 hours 15 min.

LA HISPANO HA-100-E1.

TYPE.—Two-seat Operational Trainer.

WINGS.—Low-wing cantilever monoplane. 63_2A015, 64_2A015, 63_2A013 and 64_2A013 wing sections. Aspect ratio 6.25. Chord 1.985 m. (6 ft. 6 in.) at root, 1.274 m. (4 ft. 2 in.) at tip. Dihedral 5°. Incidence 4°. Single spar duralumin and Alclad structure. All-metal flaps. All-metal statically and aerodynamically balanced ailerons. Total area of flaps 2.275 m.² (24.5 sq. ft.). Total aileron area 1.456 m.² (15.6 sq. ft.). Gross wing area 17.35 m.² (186.6 sq. ft.).

FUSELAGE.—Circular section semi-monocoque structure of duralumin and Alclad.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Areas: fin 1.32 m.² (14.2 sq. ft.), rudder 0.68 m.² (7.3 sq. ft.), tailplane 2.41 m.² (25.9 sq. ft.), elevators 0.6025 m.² (6.5 sq. ft.). Tailplane span 3.10 m. (10 ft. 2 in.).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction. Hydraulic shock-absorbers. Dunlop wheels, tyres and pneumatic brakes. Track 2.88 m. (9 ft. 5 in.). Wheelbase 1.652 m. (5 ft. 5 in.).

POWER PLANT.—One 755 h.p. E.N.M.A. Beta B-4 nine-cylinder radial air-cooled engine. de Havilland 4/2000/40SAE constant-speed airscrew. One fuel tank in fuselage (376 litres = 83 Imp gallons) and two in wings (109 litres = 24 Imp. gallons each). Total fuel capacity 600 litres (132 Imp. gallons). Oil capacity 60 litres (13.2 Imp. gallons).

ACCOMMODATION.—Two seats in tandem under sliding two-section canopy. Dual controls and duplicated instrument panels.

ARMAMENT.—Two CETME 12.7 mm. machine-guns and racks for four 8 kg. rockets or 4 × 50 kg. bombs.

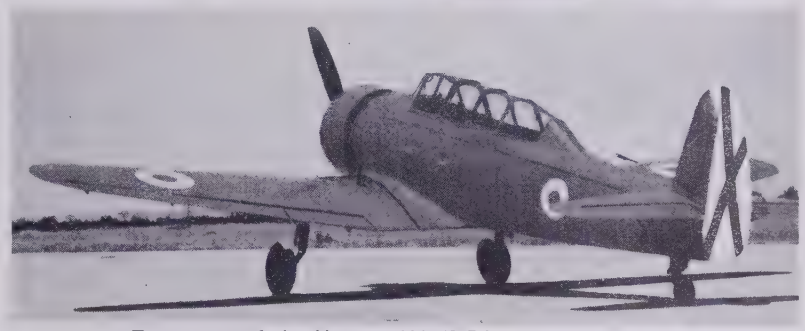
EQUIPMENT.—Complete instrumentation for blind flying training. VHF and ILS. Oxygen equipment. Camera.

DIMENSIONS.—
Span 10.37 m. (34 ft.).
Length 8.27 m. (27 ft. 1 in.).
Height 3.265 m. (10 ft. 8 in.).

WEIGHTS (Designed).—
Weight empty 1,750 kg. (3,850 lb.).
Useful load 757 kg. (1,665 lb.).
Disposable load 976 kg. (2,147 lb.).
Weight loaded 2,726 kg. (5,997 lb.).

PERFORMANCE (Estimated).—
Max. speed at S/L. 415 km.h. (258 m.p.h.).
Cruising speed (70% power) at 2,900 m. (9,150 ft.) 381.5 km.h. (237 m.p.h.).
Stalling speed 104 km.h. (64.5 m.p.h.).
Landing speed 128.2 km.h. (79.6 m.p.h.).
Initial rate of climb 650 m./min. (2,132 ft./min.).
Service ceiling 10,250 m. (33,620 ft.).
Range 1,323 km. (821 miles).
Endurance 3 hours, 28 mins.





Two views of the Hispano HA-43-D1 Advanced Trainer.



The mock-up of the Hispano HA-100-E1.

IBERAVIA

IBERAVIA S.A.

HEAD OFFICE: CARRERA DE SAN JERÓNIMO, 19 Y ARLABÁN 10, MADRID.

President: Don Pedro P. de Gandarias y Urquijo.

Director-General: Don Lázaro Ros España.

The activities of this company began in 1946 with the creation of a technical office to develop various types of aeronautical equipment. The development of aircraft was begun in 1948.

The Aircraft Department was responsible for the design of the IP-2 a two-seat training glider; the I-11 two-seat light touring monoplane; and the I-115 two-seat basic trainer. It was also engaged in the design of two helicopters, one a normal two-seater and the other a single-seat jet-driven type, when the Department was taken over by Aeronautica Industrial S.A. (AISA), which concern, incidentally, collaborated in the construction of the aircraft mentioned above. For details of these aircraft see under "AISA."

Iberavia S.A. is now solely concerned with the manufacture of aircraft accessories and equipment and the supervision and installation of airport and air navigation equipment.

Iberavia S.A. is the Spanish representative for the aeronautical products of the Bendix, Continental, Westinghouse and B.B.T. companies.

SWEDEN

SAAB



The Saab-210 Draken Tail-less Research Monoplane (Armstrong Siddeley Adder turbojet engine).

SVENSKA AEROPLAN A.B. (SAAB AIRCRAFT COMPANY).

HEAD OFFICE : LINKÖPING.

WORKS : LINKÖPING, TROLLHÄTTAN AND JÖNKÖPING.

President : Tryggve Holm.

Executive Vice-President : E. Nordquist.

Director, Trollhättan Division : Svante Holm.

Chief Engineer, Design and Development : L. Brising.

Chief Engineer, Production : B. Johnson.

Chief Engineer, Apparatus and Equipment : T. Faxén.

Sales Manager : A. Rydberg.

This company, which was founded in 1937 and has since 1940 increased its share capital to Sw. Kr. 21,000,000 has engaged in the production of all-metal military aircraft of its own design for the Royal Swedish Air Force. The company is currently producing the Saab-29, which was the first European swept-wing fighter to be put into large-scale production. Deliveries of the Saab-29 to the R.S.A.F. began in May, 1951.

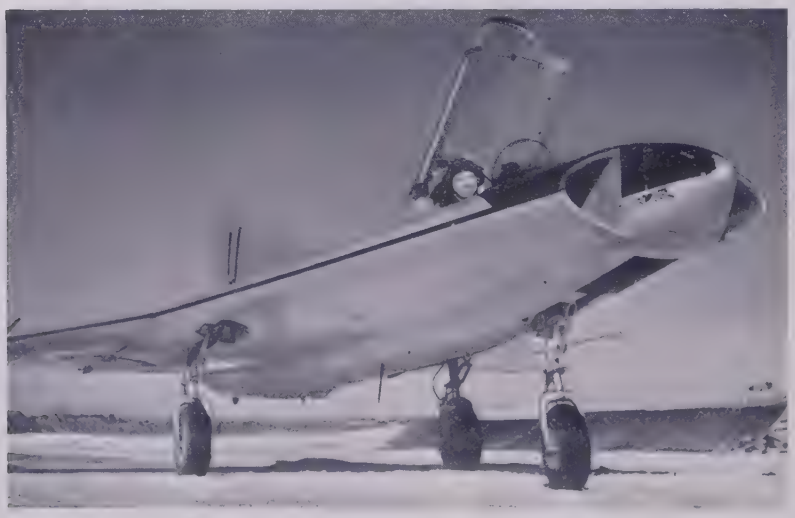
In the civil field the company has designed and built the Saab-90A-2 Scandia Airliner and the Saab-91 Safir three-seat light monoplane.

Post-war expansions of the company include a bomb-proof underground factory at Linköping, further expansion of the Trollhättan plant and the acquisition of a new factory at Jönköping, south of Lake Vättern.



An underneath view of the Saab-210 showing the "double-delta" wing plan form.

A unique trans-sonic wind-tunnel driven by four jet engines has been completed at Linköping. It is intended for research at speeds up to Mach. 1.4. Further large factory extensions are also under way at Linköping.



The Saab-210 Draken Research Monoplane.

THE SAAB-210 DRAKEN.

The Saab-210 is a small unconventional single-seat tail-less research aircraft which has been built expressly for the testing of an unusual wing configuration at subsonic speeds. The wing, which has an extremely low aspect ratio, has a plan form made up of two triangles, or what might be described as a "double-delta" form.

There is no conventional stabiliser. Elevator control is combined with the ailerons, the "elevons" being operated by a hydraulic booster system of Saab design.

Other design features include a retractable nose-wheel landing-gear, the main units of which may, for test purposes, be moved forward or backward by making only a few simple changes. Further, the C.G. may be varied in flight by pumping liquid between trim tanks in the nose and tail.

The aircraft is fitted with a wide range



The Saab-32 Lansen Two-seat All-weather Fighter (Rolls-Royce Avon turbojet engine).

of measuring equipment, including an automatic camera for photographing of instruments, and an oscillograph to register rudder forces, flight paths, etc.

Equipment includes a drag parachute and a Saab ejector-seat.

The Saab-210 which is powered by an Armstrong Siddeley Adder axial-flow turbojet engine (475 kg.=1,050 lb. s.t.), made its first flight in December, 1951, and by mid-1952 had made over 100 flights.

THE SAAB-32 LANSEN.

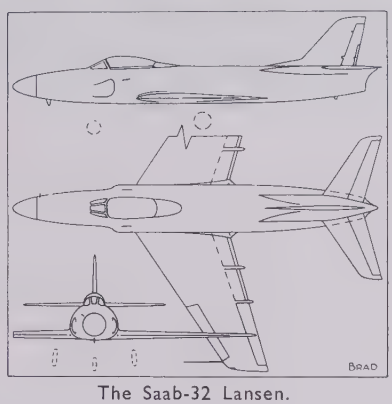
Royal Swedish Air Force designation: A 32.

The Saab-32 was designed and built for the Royal Swedish Air Force in accordance with a specification laid down by the Royal Swedish Air Board for an aircraft primarily intended for attack operations against ground and sea targets.

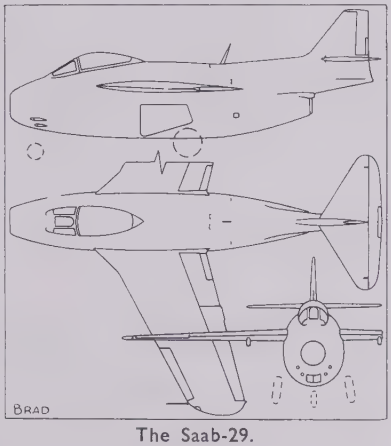
The Saab-32 two-seat all-weather attack fighter, which made its first flight on November 3, 1952, is powered by an undisclosed version of the Rolls-Royce Avon axial-flow turbojet engine. The wings, movable tailplane and fin are sharply swept back, the angle of sweep being greater than that used on the Saab-29. The twin wing is fitted with large trailing-edge Fowler-type flaps and with leading-edge slots. Both ailerons and elevators have hydraulic boost controls.

In addition to a powerful armament including cannon, bombs and rockets, the Saab-32 carries the most comprehensive electronic equipment for navigation and combat in all kinds of weather and at night.

The crew of two are seated in tandem in a pressurised cockpit equipped with Saab ejector seats.



The Saab-32 Lansen.



The Saab-29.

No details of structure or performance were available for publication at the time of closing for press.

THE SAAB-29.

Royal Swedish Air Force designations: J 29, A 29 and S 29.

The Saab-29, or Saab-1001 as the project was originally designated before it was accepted by the Royal Swedish Air Force, was the first European swept-wing jet fighter to be put into large-scale production.

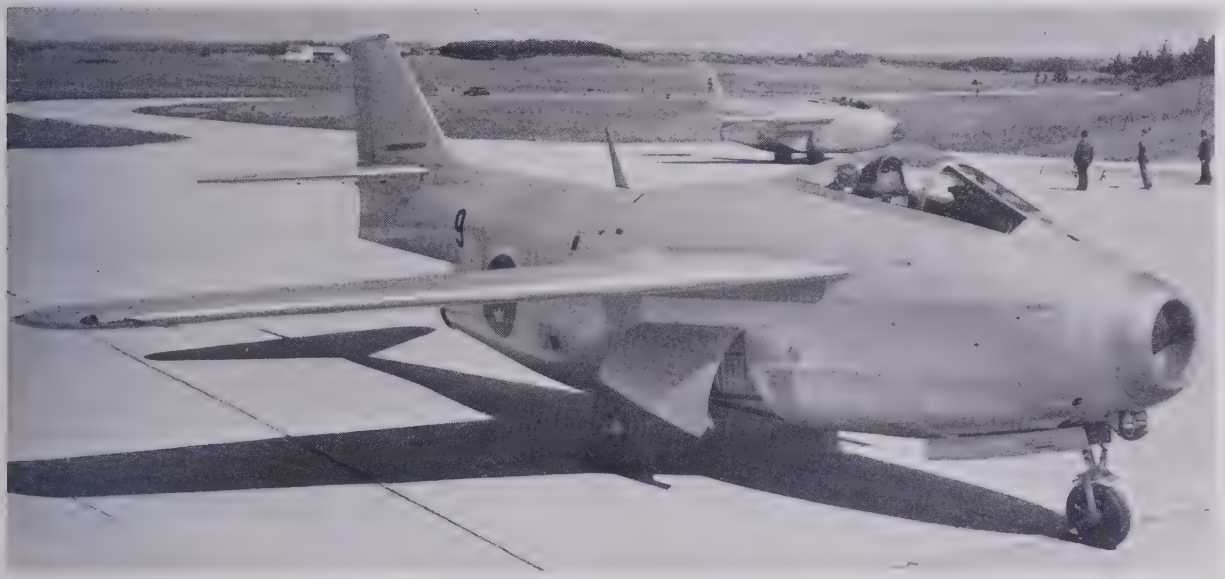
The first of three Saab-29 prototypes was test-flown on September 1, 1948, powered by a D.H. Ghost turbojet engine giving a static thrust of about 4,400 lb. (2,000 kg.). The production aircraft are fitted with 5,000-lb. (2,270-kg.) static thrust Ghost engines built under licence in Sweden by Svenska Flygmotor AB (SFA) at Trollhättan. The series prototype made its first flight in July, 1950, and quantity deliveries began in May, 1951.

The Saab-29 is in service as an Intercepter Fighter (J 29) and as an Attack Fighter (A 29). A third variant (S 29) for photographic reconnaissance is in production.

The Saab-29 is designed for a top speed of 650 m.p.h. (1,050 km.h.) (Mach. 0.86), which speed the aircraft has exceeded under full control.

TYPE.—Single-seat jet-propelled Interceptor (J29) and Ground Attack (A29) Fighter.

WINGS.—Swept shoulder-wing cantilever monoplane with 25° sweep-back. Thin laminar-flow wing section. All-metal two-spar structure with flush-riveted stressed skin, partly of 75S alloy. Automatic leading-edge slots are light alloy castings. They are locked in closed position when landing flaps are up. Ailerons operated by hydraulic booster system of Saab design.



The Saab-29 (J 29) Single-seat Interceptor Fighter (Svenska Ghost turbojet engine).



The Saab-29 (S 29) Single-seat Photographic Reconnaissance Monoplane (Svenska Ghost turbojet engine).

Air brakes in the initial series are fitted to the wing behind the rear spar, but will be fuselage-mounted in later aircraft. Gross wing area 258 sq. ft. (24.0 m.²).

FUSELAGE.—All-metal structure with flush-riveted stressed skin. Built in three sections. The straight central air duct is integral and stress-taking. Of generous cross-section, the fuselage houses the engine, landing-gear, fuel tanks, armament, etc.

TAIL UNIT.—Cantilever monoplane type. High-mounted tailplane is electrically adjustable in flight. Maximum angles +1°/—6°. The operating switch is on the pilot's stick. Two different setting speeds are available, the lower one for high-speed trimming giving a change in tailplane setting of about 1°/sec. The elevator has a mechanically operated trim-tab as an emergency precaution.

LANDING GEAR.—Retractable tricycle type. Hydraulically retracted, main wheels forward, nosewheel backwards, into the fuselage. Goodyear single-disc brakes. Designed for operation on grass airfields. Track 7 ft. 2 in. (2.2 m.).

POWER PLANT.—One Svenska (D.H. licence) Ghost 50 turbojet engine rated at 5,000 lb. (2,300 kg.) at 10,250 r.p.m. Engine mounted at three points on a strong fuselage frame. Engine cowling, stressed for tail loads, removable in one piece.

ACCOMMODATION.—Pressurised pilot's cockpit ahead of wing leading-edge. Bullet-proof wind shield and sliding canopy, the latter jettisonable with gunpowder charge. Marshall cabin blower. Pilot's ejector seat of Saab design.

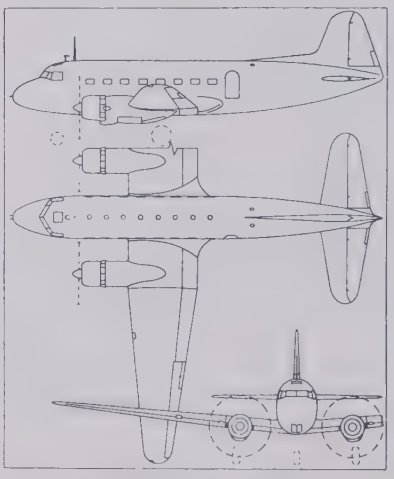
ARMAMENT.—Four 20 mm. cannon and an undisclosed number of rockets.

DIMENSIONS.—
Span 36 ft. 1 in. (11.0 m.).
Length 33 ft. 2¼ in. (10.13 m.).
Height 12 ft. 3½ in. (3.75 m.).

WEIGHTS AND PERFORMANCE.—
No details released.

THE SAAB-90 A-2 SCANDIA.

The Scandia was originally conceived in 1944 and made its first flight on November 16, 1946.



The Saab-90 A-2 Scandia Airliner.

The Scandinavian Airlines System (SAS) is operating a fleet of Scandias on its European routes.

Further aircraft have been delivered to the Brazilian VASP airline company.

The Scandia is now being built under Saab sub-contract by the Fokker company in Holland.

TYPE.—Twin-engined Airliner.

WINGS.—All-metal cantilever low-wing monoplane. Wing consists of constant-chord centre-section carrying engine nacelles, and two tapered outer sections. Stressed-skin construction. Dihedral from roots. Aspect ratio 9.15. Gross wing area 922 sq. ft. (85.7 m.²). Metal ailerons with trim-tab in port aileron. Aileron area (each) 34.7 sq. ft. (3.2 m.²). Slotted trailing-edge flaps extend under fuselage between ailerons. Total flap area 166.78 sq. ft. (15.50 m.²).

FUSELAGE.—All-metal monocoque structure of stressed skin construction.

TAIL UNIT.—Cantilever type. Trim-tabs in elevators and rudder. Tailplane span 31 ft. 8 in. (9.65 m.). Tailplane area 209.9 sq. ft. (19.5 m.²).

LANDING GEAR.—Retractable tricycle type, all wheels retracting forward, main wheels into nacelles and nose-wheel into fuselage. Hydraulic operation. Wheel track 22 ft. 10 in. (6.96 m.), wheel-base 19 ft. 5 in. (5.93 m.).

POWER PLANT.—Two Pratt & Whitney R-2180 E1 Twin-Wasp fourteen-cylinder radial air-cooled engines, each rated at 1,400 b.h.p. at 2,700 r.p.m. at 7,000 ft. (2,135 m.) and with 1,800 b.h.p. at 2,800 r.p.m. with water-injection available for



The Saab-90 A2 Airliner (two 1,400 h.p. Pratt & Whitney R-2180 Twin-Wasp engines).

take-off. Four-blade airscrews. Fuel tanks are in outer wings with consumable capacity of 638 Imp. gallons (2,900 litres). Tanks can be installed having a consumable capacity of 750 Imp. gallons (3,400 litres). Oil capacity 46 Imp. gallons (210 litres).

ACCOMMODATION.—Crew of four consisting of pilot, co-pilot, radio-operator and steward. In addition there is a seat for a flight-mechanic in the crew compartment. Aft of crew compartment is main passenger cabin with 24 seats arranged with 8 double seats on the starboard side and 8 single seats on the port side or, alternatively, 32 seats arranged in 8 slightly-staggered double seats on each side of the central aisle. Fastenings for the two sets of seats are identical in each case, and change-overs can be effected in about half an hour. Entry door on port side, main door sill 7 ft. 7 in. (2.3 m.) above ground. Aft of main cabin is the galley (on starboard side) with door to cargo compartment, and lavatory (on port side). Main cargo compartment of 225 cub. ft. (6.4 m.³) capacity is aft. Nose cargo compartment has a capacity of 11 cub. ft. (0.3 m.³) forward belly cargo compartment 80 cub. ft. (2.3 m.³) and rear belly cargo compartment 70 cub. ft. (2.0 m.³). Loading doors are on upper side of the nose (nose cargo compartment) and on starboard side (other compartments). Total cargo capacity 386 cub. ft. (11 m.³).

DIMENSIONS.—
Span 91 ft. 10 in. (28.0 m.).
Length 69 ft. 11 in. (21.3 m.).
Height 23 ft. 3 in. (7.08 m.).

WEIGHTS AND LOADINGS.—
Manufacturer's weight empty 21,960 lb. (9,960 kg.).
Max. take-off weight 35,280 lb. (16,000 kg.).
Wing loading 38 lb./sq. ft. (185 kg./m.²).
Power loading 9.8 lb./h.p. (4.5 kg./h.p.).

PERFORMANCE.—
Max. speed 280 m.p.h. (450 km.h.) at 8,500 ft. (2,590 m.).
Cruising speed 242 m.p.h. (391 km.h.) at 10,000 ft. (3,050 m.).
Stalling speed (flaps down) 80 m.p.h. (130 km.h.).
Initial rate of climb 1,350 ft./min. (410 m./min.) at max. T.O. weight.
Service ceiling 22,850 ft. (7,500 m.).
On one engine (CAR) 7,135 ft. (2,400 m.).
Max. range 1,560 miles (2,510 km.) at 10,000 ft. (3,050 m.).
Take-off distance to 50 ft. (15.21 m.) 2,700 ft. (825 m.).
Landing distance from 50 ft. (15.21 m.) 1,850 ft. (565 m.).
Single engine take-off distance (ICAO) 3,940 ft. (1,200 m.).

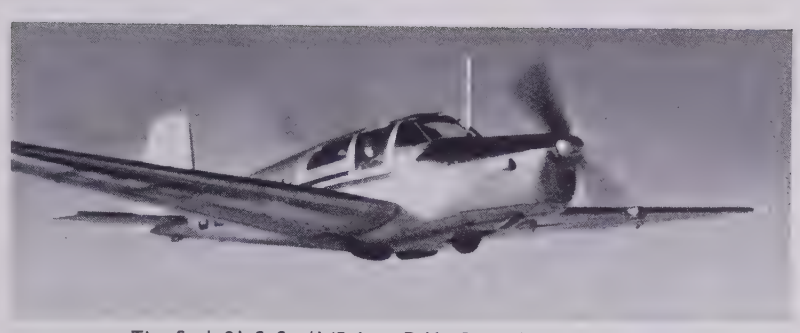
THE SAAB-91 SAFIR.

The Safir, which first flew in 1945, was originally fitted with a 130 h.p. D.H. Gipsy Major IC engine. The production model, however, is powered with a later model D.H. Gipsy Major 10 of 145 h.p. Apart from being marketed in Sweden, the Safir has been exported to various parts of the World—Argentina, Brazil, Ethiopia, Holland, India, etc.

Experimental variants of the Safir have been fitted with swept wings for research purposes.

TYPE.—Three-seat Low-wing Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Single-spar structure in two detachable sections bolted to fuselage. Metal covering in front of spar and fabric aft. Aspect ratio 8.3; taper ratio 1 : 0.45. Wing area 146.3 sq. ft. (13.60 m.²). Ailerons have Alclad-structure with fabric covering. Trim-tab in port aileron adjustable on ground. Mechanically-operated all-metal split trailing-edge flaps between ailerons and fuselage.



The Saab-91 Safir (145 h.p. D.H. Gipsy Major 10 engine).

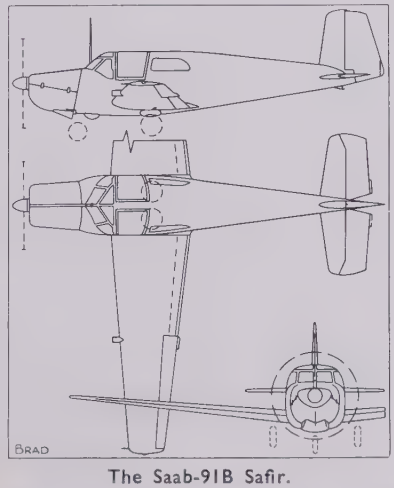
FUSELAGE.—Monocoque structure with vertical frames, longitudinal stringers and stressed Alclad skin.

TAIL UNIT.—Cantilever monoplane type. Alclad structure with metal skin over fixed surfaces and fabric covering to rudder and elevators. Controllable trim-tab in starboard elevator and adjustable balance tab in rudder.

LANDING GEAR.—Retractable tricycle-type. Main wheels, carried on oleo-spring shock-absorber legs, retract inwards into fuselage, and nose-wheel backwards into fuselage. Mechanical operation. Hydraulically-operated wheel-brakes controlled by toe-pedals.

POWER PLANT.—One 145 b.h.p. D.H. Gipsy Major 10 four-cylinder in-line inverted air-cooled engine driving two-blade airscrew. Fuel capacity 24 Imp. gallons (110 litres) with 5.5 Imp. gallons (25 litres) reserve.

ACCOMMODATION.—Enclosed cabin seating three, pilot (on port) and one passenger side-by-side in front with dual control and second passenger behind and on starboard side, with luggage compartment behind pilot. Two passenger seats may be replaced by stretcher or freight. Three hinged panels for access, which can be jettisoned in emergency. Cabin interior width 4 ft. 0 in. (1.22 m.).



The Saab-91B Safir.

DIMENSIONS.—
Span 34 ft. 9 in. (10.60 m.).
Length 25 ft. 7 in. (7.8 m.).
Height 7 ft. 3 in. (2.20 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,278-1,344 lb. (580-610 kg.) according to equipment.
Disposable load 849-915 lb. (385-415 kg.).
Weight loaded 2,195 lb. (955 kg.).
Max. overload 2,370 lb. (1,075 kg.).
Wing loading (at normal loaded weight) 15 lb./sq. ft. (73.2 kg./m.²).
Power loading 15.66 lb./h.p. (7.1 kg./h.p.).

PERFORMANCE.—
Max. speed 164 m.p.h. (265 km.h.).
Max. cruising speed 154 m.p.h. (248 km.h.).
Economical cruising speed 146 m.p.h. (235 km.h.).
Stalling speed 53 m.p.h. (85 km.h.).
Rate of climb at sea level 985 ft./min. (300 m./min.).
Cruising range 585 miles (960 km.).
Take-off run from grass 590 ft. (180 m.).
Take-off distance to 50 ft. (15.24 m.) 1,115 ft. (340 m.).
Landing run 505 ft. (154 m.).

THE SAAB-91B SAFIR.

Royal Swedish Air Force designation: Sk 50.

This version of the Safir is fitted with a 190 h.p. Lycoming O-435-A engine. The first flight was made on January 15, 1949.

The Royal Swedish Air Force had adopted the Saab-91B as a standard primary trainer and a large number is now being delivered. Owing to other military commitments the Saab company has licenced the well-known Dutch De Schelde shipbuilding company, which operates an aircraft factory at Dordrecht, near Rotterdam, to build the Saab-91B.

The Saab-91B is also being built for other customers. A fleet is also being used by Sabena (Belgian Air Lines) for airline pilot training.

POWER PLANT.—One 190 h.p. Lycoming O-435-A six-cylinder horizontally-opposed air-cooled engine driving a Hartzell two-blade variable-pitch airscrew. Fuel capacity 175 litres (38.5 Imp. gallons).

DIMENSIONS.—
Span 34 ft. 9 in. (10.6 m.).
Length 26 ft. (7.95 m.).
Height on ground 7 ft. 2 in. (2.2 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,590 lb. (722 kg.).
Weight loaded (Utility category) 2,570 lb. (1,167 kg.).
Weight loaded (Aerobatic category) 2,320 lb. (1,053 kg.).
Wing loading (Aerobatic) 15.9 lb./sq. in. (77.5 kg./m.²).
Power loading (Aerobatic) 12.2 lb./h.p. (5.53 kg./h.p.).

PERFORMANCE.—
Max. speed 171 m.p.h. (275 km./hr.).
Max. cruising speed 152 m.p.h. (245 km./hr.).
Econ. cruising speed at S/L. 137 m.p.h. (220 km./hr.).
Rate of climb at S/L. 1,140 ft./min. (5.8 m./sec.).
Service ceiling 20,500 ft. (6,250 m.).
Cruising range 680 st. miles (1,100 km.).
Take-off distance to 50 ft. (15 m.) 1,150 ft. (350 m.).
Landing distance from 50 ft. (15 m.) 1,050 ft. (320 m.).



The Saab-91B (SK 50) Safir Trainer (190 h.p. Lycoming O-435-A engine).

SWITZERLAND

THE FEDERAL AIRCRAFT FACTORY

EIDG. FLUGZEUGWERK — FABRIQUE FEDERALE D'AVIONS (Federal Aircraft Factory).

HEAD OFFICE AND WORKS: EMMEN, LUCERNE.

Director: M. Buri.

This official Government establishment manufactures aircraft for the Swiss Army Air Corps.

A design for a four-jet tail-less attack-fighter with the designation N-20 was prepared by this factory and a 6/10ths scale model glider to the same configuration was built for research and to test the stability and manoeuvrability of the swept-back wing designed for this aircraft. The N-20 glider was of all-wood construction and was fitted with a retractable nose-wheel landing-gear. The swept-back wing of low aspect ratio had a span of 7.6 m. (24 ft. 10 in.) and these were swept-back vertical surfaces but no tailplane. Accommodation was provided for a pilot and technical observer.

After a series of free flight tests this glider was fitted with four Turboméca Piméné turbojet engines (110 kg. = 242 lb. s.t. each) and was flown satisfactorily under power. The full-size N-20 was designed to be powered by four turbojet engines developed in Switzerland from the Armstrong Siddeley Mamba turboprop engine.

All work and tests on the N-20 project have now been concluded but the N-20 design has been the subject of further development as the N-2020, which will be powered by two turbojet engines each of about 3,400 kg. (7,500 lb.) static thrust. No further information concerning this project is available.

FFA

FLUG & FAHRZEUGWERKE A.G.

HEAD OFFICE AND WORKS: ALTENRHEIN BEI RORSCHACH.

President: Dr. Cl. Caroni.

Works Director: O. Eitel.

Chief Engineer, Aircraft Section: Dr. Ing. H. L. Studer.

This firm, formerly known as A.G. für Dornier-Flugzeuge was originally the Swiss branch of the German Dornier company. It is now entirely a Swiss company and builds aircraft for the Swiss Government only.

Between the years 1926 and 1937 it built mainly Dornier flying-boats, including the well-known Do X, the Dornier Wal, the Do 22 seaplane for Yugoslavia and the Do 24 flying-boat for the Netherlands. In 1937 a large number of Bücker 131 and 133 primary and aerobatic trainers were built under licence for the Swiss Air Force.

In 1939 the firm designed and built the Do 212 experimental four-seat amphibian flying-boat with submerged engine driving a propeller behind the tail by a drive shaft with cardan joints. This was the first aircraft with these features to fly (1941).

In 1938-39 a series of D.3801 (Morane-Saulnier 406) and C.3603 (Swiss Federal Factory) were built under licence for the Swiss authorities and in 1943 the D.3802 single-seat fighter powered by a 1,250 h.p. Saurer YS 2 engine was developed. This aircraft flew 13 months after the mock-up stage.

Later the D.3803 was developed from the D.3802 and a small number was built for the Swiss Government. Production was abandoned in 1946 following the decision to adopt the D.H. Vampire as the standard Swiss Air Force fighter.

The company is now building Vampire and Venom wings and other components for the Swiss Government. It also has under development a jet fighter of its own design to be known as the P.16. No details of this aircraft may yet be published.

PILATUS

PILATUS FLUGZEUGWERKE A.G.

HEAD OFFICE AND WORKS: STANS, NEAR LUCERNE.

Managing Director: H. F. Alioth.

Chief Engineer: Dipl. Ing. H. Fierz.

Pilatus Flugzeugwerke A. G. was formed in December, 1939, with a capital of two million Swiss francs and it began work in September, 1941. A founder's syndicate was formed in 1938 under the leadership of M. E. Bührle, the Swiss industrialist and owner of the Oerlikon Company, of which the Pilatus Company is now a subsidiary.

The first product of the company was the SB-2 Pelican, a four/six-seat cabin monoplane which was developed by the Swiss Aerotechnical Association at the Swiss Institute of Technology at Zürich in collaboration with the Pilatus company. The prototype was flown in 1944 and was later put into service by a Swiss air transport company.

Later productions were the P-2 advanced training monoplane, which was supplied in a small quantity to the Swiss Air Force, and the P-4 five-seat cabin monoplane. Both these aircraft, neither of which is any longer in production, have been described in previous issues of "All the World's Aircraft."

TURKEY

M.K.E.K.

MAKINE-KIMYA ENDUSTRUSU KURUMU.

HEAD OFFICE: M.K.E. GENEL MD., ANKARA.

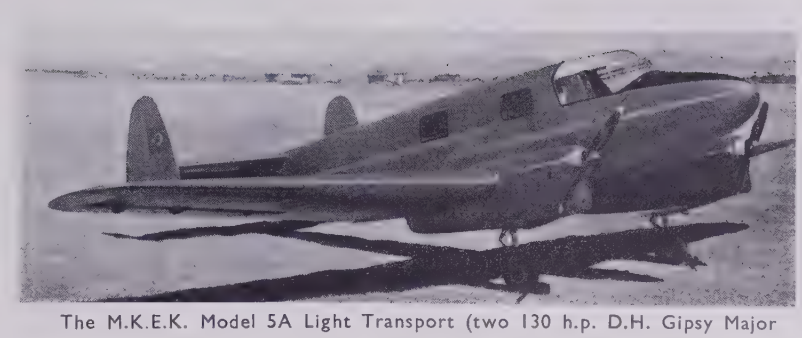
AIRCRAFT ENGINEERING DIVISION: MOTOR FB., GAZI, ANKARA.

AIRCRAFT DIVISION: UCAK FB., ETIMESUT, ANKARA.

ENGINE DIVISION: MOTOR FB., GAZI, ANKARA.

The Aircraft and Engine factories of the M.K.E.K. were founded by the Turkish Air League (Turk Hava Kurumu–T.H.K.) in 1941 and 1947 respectively and had been controlled by the League until 1952.

In 1952 they were transferred to the M.K.E.K., an establishment which includes the principal branches of the mechanical and chemical industries in Turkey. Aircraft manufacture in Turkey is now being undertaken by this State establishment.



The M.K.E.K. Model 5A Light Transport (two 130 h.p. D.H. Gipsy Major engines).

THE M.K.E.K. MODEL 1 (formerly THK-15).

TYPE.—Two-seat Trainer.

WINGS.—Low-wing cantilever monoplane. NACA 4412 wing section. Aspect ratio 7.15. Dihedral 5°. Incidence 1° at root, 0° at tip. Chord 1.95 m. (6 ft. 4½ in.) at root, 0.85 m. (2 ft. 9½ in.) at tip. Two-spar all-metal stressed-skin construction. All-metal split flaps and ailerons. Total flap area 1.433 m.² (15.4 sq. ft.). Total aileron area 1.027 m.² (11.05 sq. ft.). Gross wing area 14 m.² (150.6 sq. ft.).

FUSELAGE.—All-metal stressed-skin monocoque.

TAIL UNIT.—Cantilever monoplane type. All-metal stressed-skin construction. Areas: fin 0.496 m.² (5.34 sq. ft.), rudder 0.556 m.² (5.98 sq. ft.), tailplane 1.299 m.² (13.9 sq. ft.), elevator (total) 1.061 m.² (11.4 sq. ft.). Tailplane span 3.3 m. (10 ft. 10 in.).

LANDING GEAR.—Fixed tail-wheel type. Oleo-pneumatic (Automotive Products) shock-absorber struts. Dunlop low-pressure wheels and tyres. Track 3.0 m. (9 ft. 10 in.).

POWER PLANT.—One 145 h.p. D.H. Gipsy-Major 10 Mk. 1 four-cylinder in-line inverted air-cooled engine. Fairy Reed fixed-pitch metal airscrew. Two fuel tanks, one in each wing root between spars. Total fuel capacity 76 litres (16.7 Imp. gal.). Oil capacity 10 litres (2.2 Imp. gal.)

ACCOMMODATION.—Tandem seats with complete dual controls under a one-piece sliding canopy.

DIMENSIONS.—
Span 10.0 m. (32 ft. 9 in.).
Length 7.30 m. (23 ft. 11 in.).
Height 2.25 m. (7 ft. 4½ in.).

WEIGHTS.—
Weight empty 595 kg. (1,309 lb.).
Weight loaded 840 kg. (1,848 lb.).

PERFORMANCE (Estimated).—
Max. speed at S/L. 230 km.h. (142.8 m.p.h.).
Cruising speed (60% power) 195 km.h. (121 m.p.h.).
Min. speed 75 km.h. (46.5 m.p.h.).
Initial rate of climb 216 m./min. (710 ft./min.).
Service ceiling 4,200 m. (13,780 ft.).
Range 650 km. (405 miles).
Take-off run 150 m. (164 yds.).
Landing run 100 m. (110 yds.).

THE M.K.E.K. MODEL 2 (formerly THK-16).

This project, which has been held up, was for a small twin-jet trainer, brief details of which were given in these pages last year under the designation THK-16.

THE M.K.E.K. MODEL 3.

This will be a two-seat side-by-side primary trainer, all details of which are at present withheld.

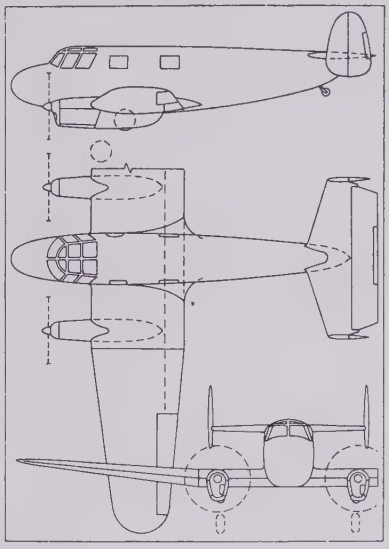
THE M.K.E.K. MODEL 4.

The Model 4 will be a military two-seat tandem primary trainer, all details of which are restricted.

THE M.K.E.K. MODEL 5 (formerly THK-5).

TYPE.—Twin-engined Light Ambulance.

WINGS.—Low-wing cantilever monoplane.



The M.K.E.K. Model 5A Light Transport.

NACA 23018-23012 wing section. Aspect ratio 7.65. Dihedral 7°. Incidence 3°. Chord 2.50 m. (8 ft. 2½ in.) at root, 1.292 m. (4 ft. 3 in.) at tip. One-piece structure with two box spars, plywood ribs and plywood stressed-skin covering. Split-type all-wood ply-covered flaps. Differentially-operated all-wood ply-covered slotted ailerons. Fixed "letter-box" type slots in leading-edge of wing ahead of ailerons. Total flap area 1.436 m.² (15.4 sq. ft.). Total aileron area 2.80 m.² (30.1 sq. ft.). Gross wing area 28 m.² (300 sq. ft.).

FUSELAGE.—All-wood monocoque structure with vertical frames, longitudinal stringers and stressed plywood skin.

TAIL UNIT.—Cantilever monoplane type. Single-piece tailplane with twin fins and rudders as endplates. Tailplane has two-spar structure with plywood covering. Single-piece elevator has wood framework and fabric covering, and has controllable trim-tab in centre. Vertical surfaces are of wood with plywood covering for fins and fabric-covering for rudders. Trim-tab in port rudder adjustable from pilot's cockpit. Areas: fins 1.77 m.² (19.0 sq. ft.), rudders 1.34 m.² (14.4 sq. ft.), tailplane 3.10 m.² (33.3 sq. ft.), elevator 2.14 m.² (23.0 sq. ft.). Tailplane span 4.15 m. (13 ft. 7 in.).

LANDING GEAR.—Fixed tail-wheel type. Main wheels on J.A.R.U. oleo-pneumatic shock-absorber legs. Dunlop differentially-operated pneumatic wheel brakes. Oleo-sprung fully-castoring tail-wheel. Track 3.60 m. (11 ft. 9½ in.).

POWER PLANT.—Two 130 h.p. D.H. Gipsy Major four-cylinder in-line inverted air-cooled engines. Two-blade MKEK wood fixed-pitch aircrews. Two welded aluminium sheet fuel tanks in wings, one on each side of fuselage inboard of engine nacelles. Total fuel capacity 300 litres (66 Imp. gal.). Welded aluminium oil tank in each engine nacelle. Total oil capacity 20 litres (4.5 Imp. gal.).

ACCOMMODATION. Enclosed accommodation for pilot and co-pilot side-by-side with dual controls. Door to flight compartment on starboard side. Cabin takes one or five stretchers, with seat for medical attendant. Large door on starboard side for loading stretchers. Main cabin sound-proofed, cockpit and cabin heated separately. Individual ventilating arrangements.

DIMENSIONS.—
Span 14.64 m. (48 ft.).
Length 10 m. (32 ft. 9½ in.).
Height 3.10 m. (10 ft. 2 in.).

WEIGHTS.—
Weight empty 1,450 kg. (3,190 lb.).
Weight loaded 1,900 kg. (4,180 lb.).

PERFORMANCE.—
Max. speed at S/L. 205 km.h. (127 m.p.h.).
Cruising speed 160 km.h. (99 m.p.h.).
Min. speed (with flaps) 100 km.h. (62 m.p.h.).
Initial rate of climb 192 m./min. (630 ft./min.).
Service ceiling 4,000 m. (13,120 ft.).
Range 650 km. (405 miles).
Take-off run 210 m. (230 yds.).
Landing run 195 m. (213 yds.).

THE M.K.E.K. MODEL 5A (formerly THK-5A).

TYPE.—Twin-engine Light Transport.

WINGS, FUSELAGE, TAIL UNIT, LANDING GEAR AND POWER PLANT.—Same as for M.K.E.K. Model 5.

ACCOMMODATION.—Pilot and co-pilot side-by-side with dual controls in crew compartment, seats for four passengers in cabin. Large door on starboard side gives access to both crew compartment and cabin. Luggage compartment aft of cabin accessible from inside only. Cabin is soundproofed, heated and has individual ventilation for each passengers.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—Same as for M.K.E.K. Model 5.

THE M.K.E.K. MODEL 6 (formerly THK-14).

The M.K.E.K. Model 6 is a two-seat, high-wing training sailplane. It has a wooden monocoque fuselage of circular cross-section and the wing is a wooden single-spar structure with constant taper in chord and thickness. The tail-unit is a cantilever monoplane structure and the landing-gear consists of a skid under the fuselage and a single wheel. An enclosed cabin in the nose accommodates the crew of two side-by-side.

DIMENSIONS.—
Span 16 m. (52 ft. 6 in.).
Length 7.9 m. (25 ft. 11 in.).
Wing area 22.83 m.² (245 sq. ft.).
Aspect ratio 11.2

WEIGHT AND LOADING.—
Weight empty 260 kg. (572 lb.).
Weight loaded 420 kg. (930 lb.).
Wing loading 18.4 kg./m.² (3.77 lb./sq. ft.).

PERFORMANCE.—
Max. gliding speed 181 km.h. (112 m.p.h.).
Min. speed 53.5 km.h. (33.2 m.p.h.).
Max. permissible diving speed 502 km.h. (312 m.p.h.).

THE M.K.E.K. MODEL 7 (formerly THK-2).

TYPE.—Single-seat Aerobatic Trainer.

WINGS.—Low-wing cantilever monoplane. NACA2412 wing section. Aspect ratio 6.4. Wings of elliptical plan form. Wood single spar structure with a plywood leading-edge forming a D-shaped torsional box member. Hand-operated split metal flaps. Ailerons have fabric-covered wood frames. Total area of flaps 0.93 m.² (10 sq. ft.). Total area of ailerons 1.386 m.² (14.9 sq. ft.). Gross wing area 10.4 m.² (112 sq. ft.).

FUSELAGE.—Wooden monocoque structure with plywood skin.

TAIL UNIT.—Cantilever monoplane type. All-wood framework with plywood-covered tailplane and fin and fabric-covered rudder and elevators. Adjustable trim-tab in elevator controlled from pilot's cockpit. Areas: fin 0.40 m.² (4.3 sq. ft.), rudder 0.60 m.² (6.45 sq. ft.), tailplane 0.85 m.² (9.1 sq. ft.), elevators 0.78 m.² (8.4 sq. ft.). Tailplane span 2.50 m. (8 ft. 2½ in.).

LANDING GEAR.—Retractable type. Wheels raised backwards, turning through 90 degrees to lie flat in the wing when raised. Oleo shock-absorbers. Hand retraction. Swivelling tail-wheel fitted with compression rubber shock-absorber. Track 1.50 m. (4 ft. 11 in.).

POWER PLANT.—One 130 h.p. D.H. Gipsy Major four-cylinder inverted air-cooled engine. M.K.E.K. two-blade wood airscrew. Fuel tank in fuselage between engine and cockpit. Fuel capacity 70 litres (15.4 Imp. gal.).

ACCOMMODATION.—Enclosed cockpit with sliding canopy. Conventional controls and instrument equipment.

DIMENSIONS.—
Span 8.0 m. (26 ft. 3 in.).



The M.K.E.K. Model 7 Single-seat Trainer (130 h.p. D.H. Gipsy Major engine).

Length 7.20 m. (23 ft. 7 in.).
Height 2.08 m (6 ft. 10 in.).

WEIGHTS.—
Weight empty (with equipment 497.5 kg. (1,095 lb.).
Weight loaded 657 kg. (1,443 lb.).

PERFORMANCE.—
Max. speed at sea level 260 km.h. (164.5 m.p.h.).
Cruising speed (60% power) 220 km.h. (136.4 m.p.h.).
Min. speed 81 km.h. (50 m.p.h.).
Initial rate of climb 290 m./min. (950 ft./min.).
Service ceiling 4,800 m. (15,745 ft.).
Range in still air 650 km. (405 miles).
Take-off run 154 m. (168 yds.).
Landing run 135 m. (147 yds.).

THE UNITED STATES OF AMERICA

THE DESIGNATION OF AMERICAN SERVICE AIRCRAFT.

The U.S. Air Force and U.S. Navy use separate and distinctive systems to designate their aircraft. The two schemes currently in use are described below.

The U.S. Air Force.

Aircraft of the U.S.A.F. are identified by a system in which the function of the aircraft is shown by letters.

B Bomber	Q Target and Drone
C Cargo and Transport	R Reconnaissance
F Fighter	S Search and Rescue
H Helicopter	T Trainer
L Liaison	X Special Research

These symbols are used either singly or, where an aircraft fulfils more than one function, in combination (*i.e.* TF, Fighter-Trainer, RB, Reconnaissance-Bomber, etc.), the symbols being followed by a number to indicate the model, the numbers running consecutively throughout the class or function irrespective of manufacturer. The letter A, for amphibian, is used in conjunction with other functional letters (*i.e.* SA, Search-amphibian), but never alone.

Model changes are indicated by letters immediately following the basic model number (*i.e.* F-86A, F-86E, etc.). These qualifying letters usually indicate changes in power-plant, structure and/or equipment which affect interchangeability of parts and components, maintenance or tactical use.

The prefixes X, to indicate prototype ; Y, limited procurement for service trials ; and Z, obsolete ; are still used.

U.S. Naval Aviation.

U.S. Naval aircraft are designated by a system which incorporates letters to define the function and identify the manufacturer of the aircraft, and numbers to indicate the model and modifications of the model.

The functions of fixed-wing piloted aircraft are covered by the following letters :—

A Attack	S Anti-submarine
F Fighter	T Trainer
O Observation	U Utility
P Patrol	W Special Search
R Transport	

Rotary-wing aircraft, or Helicopters, have the Symbol H with additional qualifying functional letters, thus :—

HH Search and Rescue	HR Transport
HO Observation	HS Anti-submarine
HT Training	HU Utility

A series of suffix letters to follow the model number is also used to indicate special modifications or specially-equipped versions of otherwise standard types. These are as follow :—

A Amphibian	M Weather Reconnaissance
B Special Armament	N Night-operating aircraft
C Carrier conversion of non-carrier type	P Photo-Reconnaissance
D Drone Control	Q Counter-measures Aircraft
E Special Electronic Gear	R Transport
G Search and Rescue	S Anti-submarine Warfare equipment
H Ambulance	T Training
J Target Tug	U Utility
K Target Drone	W Special Search
L Searchlight	Z Administrative.

The individual aircraft designations are made up of the functional letter, a model number, the manufacturer's letter and following a hyphen, a modification or mark number. For example, AD-1 broken down to its component symbols indicates that the aircraft is an Attack type (A) built by Douglas (D) and that it is the first (-1) variation or mark of the basic type. Developments of this aircraft are the AD-2, AD-3 and AD-4. Typical specially equipped versions of this aircraft indicated by suffix letters are the AD-3Q (radar counter-measure version), AD-3N (night bomber version) and AD-3W (weather scout version). The next entirely new Attack design by Douglas is the A2D-1.

The list below details the letters which have been allotted to aircraft manufacturers :—

B { Beech Aircraft Corporation { Boeing Aircraft Company	M Glenn L. Martin Company
D Douglas Aircraft Company, Inc.	N Naval Aircraft Development Center
E { Cessna Aircraft Company, Inc. { Hiller Helicopters, Inc.	P Piasecki Helicopter Corporation
F Grumman Aircraft Engineering Corporation	Q Fairchild Engine and Aircraft Corporation
H McDonnell Aircraft Corporation	R Ryan Aeronautical Company
J North American Aviation, Inc.	S Sikorsky Aircraft (United Aircraft Corporation)
K Kaman Aircraft Corporation.	T Northrop Aircraft, Inc.
L Bell Aircraft Corporation	U Chance Vought Aircraft (United Aircraft Corporation)
	V Lockheed Aircraft Corporation
	Y Consolidated Vultee Aircraft Corporation

NOTE : In 1952 it was announced that any aircraft ordered by both the U.S. Air Force and the U.S. Navy will retain the basic designation allotted by the first service to order it. The first example of this is provided by the North American trainer originally ordered by the U.S.A.F. as the T-28A. Subsequently adopted by the U.S. Navy, the naval version carried the designation T-28B.

AERO

AERO DESIGN AND ENGINEERING CORPORATION.

HEAD OFFICE: P.O. BOX 118, BETHANY, OKLAHOMA.

President: Rufus T. Amis, Jr.
Vice-President: W. D. Amis.
General Manager: T. R. Smith.
Engineering Manager: W. B. Hobbs.
Secretary: Nelson Hall.
Treasurer: Budd Parks.

This Company has designed the all-metal Aero Commander twin-engined six/seven-seat light transport monoplane. The Aero Commander Model 520 received its Approved Type Certificate on January 31, 1952, and is now in production.

The U.S. Army has acquired three Commander 520's for service trials. These aircraft carry the designation L-26.



The Aero Commander 520 (two 260 h.p. Lycoming GO-435 engines).

THE AERO COMMANDER 520.

U.S. Army designation: L-26.

TYPE.—Twin-engined light transport Monoplane.

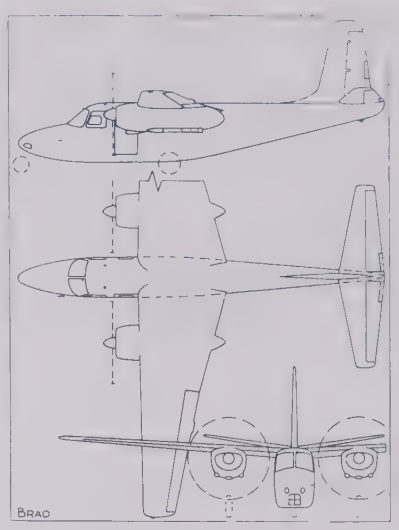
WINGS.—Cantilever high-wing monoplane. Wing section NACA 23012 modified. Aspect ratio 8.3 : 1. Chord (root) 8 ft. 4 in. (2.54 m.), (tip) 2 ft. 9 in. (1.14 m.). Dihedral 4°. Incidence 3° at root. All-metal structure. Hydraulically-operated flaps between ailerons and fuselage. Total flap area 32.7 sq. ft. (3.04 m.²), total aileron area 20.5 sq. ft. (1.90 m.²). Gross wing area 242.5 sq. ft. (22.53 m.²).

FUSELAGE.—All-metal structure with sheet metal covering.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with metal covering over all surfaces. Trim-tabs in elevators and rudder. Dihedral tailplane. Tailplane span 15 ft. (4.57 m.). Areas: fin 22.63 sq. ft. (2.10 m.²), rudder 11.19 sq. ft. (1.04 m.²), tailplane 33.06 sq. ft. (3.07 m.²), elevators 20.54 sq. ft. (1.91 m.²).

LANDING GEAR.—Retractable tricycle type. Air-oil shock-absorbers. Hydraulic retraction. Goodyear wheels and Goodyear disc-type brakes. Track 12 ft. (3.66 m.). Wheelbase 17 ft. 4 in. (5.28 m.).

POWER PLANT.—Two 260 h.p. Lycoming GO-435-C2B six-cylinder horizontally-opposed air-cooled engines driving Hartzell two-blade constant-speed full-feathering metal airscrews. Fuel capacity 150 U.S. gallons (492 litres) in five bag-type cells in wing.



The Aero Commander 520.

ACCOMMODATION.—Enclosed cabin of 120 cub. ft. (3.4 m.³) capacity with six or seven seats; two side-by-side in front with dual controls, a similar pair behind and a full-width seat at the rear seating two. Seventh seat optional. Main entry door under wing on port side. Door 20 in. (50.8 cm.) from ground. All equipment can be removed to permit cabin to be used for freight-carrying, and floor may be reinforced. Optional arrangement provides for both passengers and freight. Baggage compartment aft of cabin with capacity of 40 cub. ft. (1.13 m.³).

DIMENSIONS.—
Span 44 ft. 7 in. (13.60 m.).
Length 34 ft. 6 in. (10.52 m.).
Height 14 ft. 4½ in. (4.39 m.).

WEIGHTS AND LOADINGS (Designed).—
Weight empty 3,700 lb. (1,680 kg.).
Weight loaded 5,500 lb. (2,500 kg.).
Wing loading 22.72 lb./sq. ft. (104.67 kg./m.²).
Power loading 10.57 lb./h.p. (4.79 kg./h.p.).

PERFORMANCE.—
Max. speed 211 m.p.h. (337.6 km.h.) at sea level.
Cruising speed (60% power) 197 m.p.h. (315 km.h.) at 10,000 ft. (3,050 m.).
Stalling speed (flaps down) 57 m.p.h. (91 km.h.).
Initial rate of climb 1,800 ft./min. (550 m./min.).
Service ceiling 24,400 ft. (7,440 m.).
Cruising range 1,150 miles (1,840 km.).
Take-off distance to clear 50 ft. (15.25 m.) 950 ft. (290 m.).

AEROCAR

AEROCAR, INC.

HEAD OFFICE AND WORKS: LONGVIEW AIRPORT, WASH.

President and General Manager: Moulton B. Taylor.

Aerocar, Inc. was formed in February, 1948, to develop and build a flying automobile which has been designed by Mr. M. B. Taylor. A quarter scale model of the Aerocar was tested in the aeronautical laboratory of the University of Washington before actual construction of the prototype was begun in July, 1948. The prototype was completed in October, 1949 and has since been fully tested as both aircraft and automobile in over 25,000 miles of travel.

The company's facilities are being enlarged to permit the manufacture of a limited number of Aerocars. Four were nearing completion early in 1953, and C.A.A. certification was expected in June.

THE AEROCAR MODEL TWO.

The Aerocar is a convertible aeroplane and road vehicle which incorporates a number of features not previously introduced in craft of this type.

The four-wheel automobile section accommodates two seated side-by-side and encloses in the rear portion a 135 h.p. Lycoming engine which provides front-wheel automobile drive and drives a pusher propeller aft of the tail-unit. A three-control flight system is combined with the automobile controls, the same wheel being used for both. Conventional clutch and foot brake pedals are provided, together with three forward speeds and reverse in the wheel drive.

The flight section consists of a pair of rigidly-braced wings and a tail section which carries the tail and encloses the drive for the pusher propeller. When the flight section is detached from the body the wings, which have trailer wheels inset in the leading-edges of the wing roots, may be stowed on each side of the tail section and the flight section towed tail first behind the automobile section. The change-over from road transportation to aircraft can be accomplished without special equipment by one person and all component locks are fool-proof.

TYPE.—Two/three-seat Flying Automobile.

WINGS.—High-wing rigidly-braced monoplane. Wing section NACA 42012. Aspect ratio 6. Dihedral 2°. 24ST aluminium-alloy structure. Area of ailerons (two) 30 sq. ft. (2.78 m.²). Gross wing area 190 sq. ft. (17.6 m.²).

FUSELAGE.—In two parts, the automobile body section and a detachable rear section carrying tail and propeller drive. 24ST aluminium-alloy construction, the auto body being covered with Fibreglas. The tail section is a monocoque.

TAIL UNIT.—Dihedral tailplane with fin and rudder beneath. 24ST aluminium-alloy construction.

LANDING GEAR.—Dual-purpose quadricycle type. Gabriel Automotive hydraulic shock-absorbers. Magnesium wheels with 4.50 × 12 tyres. Goodrich expander tube brakes. Fluid-drive to front wheels for road traction. Wheel track 5 ft. 2 in. (1.57 m.). Wheel base 6 ft. 11 in. (2.13 m.).

POWER PLANT.—One Lycoming O-290-D2 engine with a normal rating of 135 h.p. and with 140 h.p. available for take-off. Hartzell ground-adjustable pusher propeller. Fuel capacity 24 U.S. gallons (90 litres). Oil capacity 2 U.S. gallons (7.5 litres).

EQUIPMENT.—Includes windshield wiper, horn, battery, starter, generator, and all air and



The Aerocar Two-seat Roadable Monoplane in flight.

road lights and instruments required by U.S. vehicle codes.

DIMENSIONS (Aircraft).—
Span 34 ft. (10.37 m.).
Length 21 ft. (6.40 m.).
Height 7 ft. 2 in. (2.18 m.).

DIMENSIONS (Automobile).—
Length 10 ft. 4 in. (3.15 m.).
Trailer length 14 ft. (4.27 m.).
Overall car/trailer length 25 ft. (7.62 m.).
Height 5 ft. 4 in. (1.62 m.).
Auto wheel track 5 ft. 2 in. (1.57 m.).
Auto wheel base 6 ft. 11 in. (2.13 m.).
Max. width of trailer 8 ft. (2.44 m.).

WEIGHTS AND LOADINGS.—
Weight empty (auto) 1,012 lb. (460 kg.).
Pilot and passenger 340 lb. (154 kg.).
Fuel and oil 144 lb. (65 kg.).
Baggage 60 lb. (27 kg.).
Trailer (wings and tail) 344 lb. (156 kg.).
Flying weight loaded 1,900 lb. (862 kg.).
Wing loading 10 lb./sq. ft. (48.8 kg./m.²).
Power loading 14.1 lb./h.p. (6.35 kg./h.p.).

PERFORMANCE (Aircraft).—
Max. speed over 110 m.p.h. (176 km.h.).
Cruising speed over 100 m.p.h. (160 km.h.).
Landing speed (with flaps) 53 m.p.h. (84 km.h.).
Initial rate of climb over 500 ft./min. (152 m./min.).
Service ceiling 12,000 ft. (3,660 m.).
Cruising range 300 miles (480 km.).
Take-off run 655 ft. (200 m.).
Landing run 300 ft. (91.5 m.).
Distance to clear 50 ft. (15.25 m.) 1,225 ft. (374 m.).

PERFORMANCE (Automobile).—
Max. road h.p. 40.
Designed road speed 50 m.p.h. (80 km.h.).
Road range over 500 miles (800 km.).
Road turning radius 15 ft. (4.57 m.).

AERONCA

THE AERONCA MANUFACTURING CORPORATION.

HEAD OFFICE AND WORKS: MIDDLETOWN MUNICIPAL AIRPORT, OHIO.

President: John A. Lawler.

Director of Engineering: George A. Page.

Chief Engineer: Leon C. Wolfe.

Secretary and Treasurer: S. J. Kuderer.

This Company was incorporated as the Aeronautical Corporation of America in November, 1928, and was the first American company to build and market a truly light aeroplane.

In mid-1950 Aeronca abandoned light aeroplane manufacture when it began producing parts and sub-assemblies of military aircraft under sub-contract in connection with the U.S. defense programme. The name of the company was then changed to the Aeronca Manufacturing Corporation. Latest production is concerned with assemblies and sub-assemblies for the Boeing B-47 and B-52 bombers.

While this work continues, Aeronca is preparing to re-enter the civil aircraft market with a new ten-seat twin-engined executive transport to be powered by two 1,525 h.p. Wright R-1820 Cyclone engines. The prototype is under construction and will probably fly in 1954. The aircraft will be a high-wing monoplane and the pressurised cabin will seat eight passengers. No further details are available.

AMERICAN HELICOPTER

AMERICAN HELICOPTER COMPANY, INC.

HEAD OFFICE: 3613, AVIATION BOULEVARD, MANHATTAN BEACH, CALIFORNIA.

Incorporated: July 2, 1947.

President and General Manager: Corwin D. Denny.

Vice-President–Power-plants: Richard E. Getz.

Vice-President–Engineering: Howard E. Roberts.

Vice-President–Manufacturing: Joseph A. Geisler.

Secretary: John A. White.

Treasurer: Joseph Schneider.

The American Helicopter Co., Inc. was formed in 1947 for the express purpose of developing and building various sizes of pulse-jet driven helicopters. Its first product was the A-5 experimental pulse-jet-powered helicopter, which was designed and built in 1948. Initial flight tests were made in January, 1949, and shortly thereafter, the U.S.A.F. granted sponsorship for further development work.

A second experimental pulsejet-powered helicopter, the XA-6, was designed and built in 1950 and flown in February, 1951.

The company has now developed, under the sponsorship of the Department of the Army Ordinance Corps, the XH-26 single-seat pulsejet helicopter. The Army specified that the helicopter should be collapsible, capable of being air-dropped to units in the field and quickly assembled for observation operations.

The contract for the XH-26 was awarded in June, 1951 and the prototype flew for the first time on June 30, 1952.

All airframe and rotor development work is done at the company's two Manhattan Beach, Cal., plants, and all power-plant development is undertaken at a factory located at Mesa, Arizona. The company's available production facilities cover an area of over 100,000 square feet.

THE AMERICAN HELICOPTER XH-26.

The XH-26 is a small pulsejet-driven helicopter which has been developed for the U.S. Army. It is a single-seat craft which has been designed to be collapsed into a container 5 ft. × 5 ft. × 14 ft. (1.52 m. × 1.52 m. × 4.27 m.), dropped by parachute from a transport into a combat area, unpacked and assembled by two men and put into the air in about twenty minutes.



The American Helicopter XH-26 pulse-jet-driven Helicopter.

The XH-26 is intended primarily for observation but with only slight modification to the basic structure two stretchers can be carried, one on each side of the body, for casualty evacuation. Stripped for an air drop it weighs less than 300 lb. (136.2 kg.). With pilot, fuel and radio the weight is about 700 lb. (317.8 kg.). The maximum load which can be carried is 600 lb. (272.4 kg.).

Although a three-wheel landing-gear is shown in the accompanying illustration of the XH-26, this gear is interchangeable with a simple skid gear.

The XH-26 is powered by two 6.75 in. (17.84 cm.) pulsejets, one at each rotor-blade tip. These pulsejets, which are of the company's own design, weigh 16 lb. (7.26 kg.) each and burn either gasoline, kerosene or diesel fuel oil.

The tip-mounted engines are free-swivelling and automatically assume a horizontal position when started. Pitch of the blades can be changed without altering the position of the engines. The pressing of a starter-button on the cyclic-pitch control stick injects air and fuel into the engine, during which time a small sparking plug is energised to ignite the mixture. When the engine is operating the sparking-plug is turned off.

A very small tail rotor driven by belts, is fitted to improve directional control. It is not an anti-torque rotor as no torque is generated in the fuselage with tip-mounted engines.

The top speed of the XH-26 is about 80 m.p.h. (128 km.h.) and its endurance is about 1½ hours.

ANDERSON GREENWOOD

ANDERSON, GREENWOOD & COMPANY.

HEAD OFFICE AND WORKS: 1400, NORTH RICE AVENUE, BELLAIRE, TEXAS.

President: Ben M. Anderson.

Vice-President: Marvin Greenwood.

Secretary and Chief Engineer: Lomis Slaughter, Jr.

The Anderson Greenwood company was originally incorporated in 1941 for personal aircraft research but when the U.S.A. entered the war the company closed down and the three officials mentioned above joined the Boeing company, all three eventually holding responsible positions in the engineering department.

The company was re-formed after the war, when it undertook the design and construction of the AG-14 two-seat light monoplane. The first prototype flew for the first time on October 1, 1947, and a production prototype was test-flown on June 1, 1950. This latter aircraft was given its Approved Type Certificate on September 21, 1950. Four further aircraft were built, but production of the AG-14, which has been illustrated and described in previous editions of this Annual, was suspended at the end of 1950 in order to give priority to essential defence production.

In 1951, the company undertook military design work for the Consolidated Vultee Aircraft Corporation, and in 1952 began highly classified design work for both the Seattle and Wichita divisions of the Boeing Airplane Company.

Anderson Greenwood is also engaged in the development of missile and aircraft power-plants of its own design.

BAUMANN

BAUMANN AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: 12270, MONTAGUE STREET, PACOIMA, CALIFORNIA.

President: J. B. Baumann.

The Baumann Aircraft Corpn. was formed in 1945 by Mr. J. B. Baumann and a group of designers and builders, who have been working together for several years. Their first design was the Model B-250 Brigadier, a twin-engined pusher monoplane intended for executive transport duties. The prototype Brigadier first flew in June, 1947.

Pilot production of the B-290, which is identical to the B-250 except that it is fitted with engines of higher rating, has begun. The company plans to have production up to one Brigadier per week by the middle of 1954.

The Baumann Aircraft Corporation built the Custer CCW-5 for the Custer Channel Wing Corporation, of Hagerstown, Md. The CCW-5 is essentially a standard Brigadier except for the "channel-wing" and larger engines.



The Baumann B-290 Brigadier (two 145 h.p. Continental engines).

THE BAUMANN B-290 BRIGADIER.

TYPE.—Twin-engined five-seat pusher monoplane.

WINGS.—Cantilever shoulder-wing monoplane. Metal spars and ribs and sheet metal covering. All-metal ailerons, with hydraulically-operated all-metal split trailing-edge flaps between nacelles and fuselage. Wing area (approximate) 207 sq. ft. (19.23 m.²).

FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. Metal framework with metal covering for all surfaces. Controllable rudder and elevator trim-tabs. Tailplane span 13 ft. 2 in. (4.01 m.).

LANDING GEAR.—Retractable tricycle type. Main wheels, on single oleo shock-absorber legs, retract outward into wings outboard of engines. Hydraulic operation. Hydraulic brakes and Goodyear tyres. Track 11 ft. 6 in. (3.5 m.). Nose-wheel is steerable.

POWER PLANT.—Two 145 h.p. Continental C145-H six-cylinder horizontally-opposed air-cooled engines mounted within centre-section as pusher units and driving Sensenich two-blade propellers. Fuel capacity 76 U.S. gallons (288 litres).

ACCOMMODATION.—Enclosed cabin seating pilot (on port) and one passenger side-by-side with dual controls, and full-width seat for three passengers behind. Access door on port side. Baggage compartment of 70 cub. ft. (1.98 m.³) capacity aft of rear seats.

DIMENSIONS.—
Span 41 ft. (12.49 m.).
Length 27 ft. 5 in. (8.36 m.).
Height (overall) 10 ft. 2 in. (3.10 m.).

WEIGHTS AND LOADINGS.
Weight empty 2,200 lb. (1,000 kg.).
Disposable load 1,300 lb. (590 kg.).
Payload 700 lb. (318 kg.).
Weight loaded 3,500 lb. (1,590 kg.).
Wing loading 16.9 lb./sq. ft. (82.4 kg./m.²).
Power loading 12 lb./h.p. (5.45 kg./h.p.).

PERFORMANCE.—
Max. speed 190 m.p.h. (304 km.h.).
Max. speed on one-engine 110 m.p.h. (177 km.h.).
Cruising speed (75% power) 165 m.p.h. (264 km.h.).
Landing speed (without flaps) 63 m.p.h. (101 km.h.).
Landing speed (with flaps) 57 m.p.h. (91.2 km.h.).
Stalling speed (power off) 57 m.p.h. (91.2 km.h.).
Stalling speed (power on) 45 m.p.h. (72 km.h.).
Initial rate of climb 1,250 ft./min. (381 m./min.).
One-engine rate of climb 450 ft./min. (137 m./min.).
Service ceiling 18,000 ft. (5,485 m.).
One-engine ceiling 8,000 ft. (2,440 m.).
Cruising range 750 miles (1,200 m.).

BEECHCRAFT

BEECH AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: EAST CENTRAL AVENUE, WICHITA, KANSAS.

President: Mrs. Walter H. Beech.

Vice-President—Manufacturing: C. C. Pearson.

Vice-President—Contract Administration: James N. Lew.

Vice-President—Military Sales: Lynn D. Richardson.

Vice-President and General Manager: J. P. Gaty.

Vice-President and Chief Engineer: T. A. Wells.

Vice-President and Co-ordinator: Frank E. Hedrick.

Secretary and Treasurer: John A. Elliott.

Founded in 1932 by the late Walter H. Beech, pioneer designer and builder of light aeroplanes in the United States, the Beech Aircraft Corporation is currently engaged in the production of both military and civil versions of the twin-engined Model D18S, the single-engined four-seat Model 35 Bonanza and the twin-engined six-seat Model 50 Twin-Bonanza.

Beech has rebuilt over 900 wartime C-45 twin-engined trainers for the U.S.A.F. AT-7, AT-11 and C-45 aircraft are involved in the programme, the rebuilds being designated C-45G. Contracts have also been completed for a large number of similar trainers for the Canadian Government.

Under development is a new advanced trainer-transport to be known as the T-36A. Contracts for the production of this aircraft for the U.S.A.F. by both Beech and Canadair, Ltd. of Montreal, Canada, were cancelled early in 1953, but two prototypes will be completed for test and evaluation.

The T-34 has been selected by the U.S.A.F. as a replacement for the T-6 Texan for primary training and has been ordered into quantity production. The T-34 will be built by both Beech and the Canadian Car and Foundry Co., Ltd. of Fort William, Ontario, Canada.

THE BEECHCRAFT T-36A.

The T-36A, two prototypes of which are being built, is an advanced trainer or military transport which will be powered by two 2,100 h.p. Pratt & Whitney R-2800 engines. As a trainer it will carry a crew of four and as a transport a crew of two and twelve passengers. Its general arrangement can be gathered from the accompanying illustration.

DIMENSIONS.—
Span 70 ft. (21.35 m.).
Length 52 ft. 2 in. (15.91 m.).
Height 21 ft. 5 in. (6.52 m.).

WEIGHT (Designed).—
Max. take-off weight over 25,000 lb. (11,350 kg.).

PERFORMANCE (Estimated).—
Max. speed over 300 m.p.h. (480 km.h.).
Service ceiling 34,000 ft. (10,370 m.).
Combat radius 650 miles (1,040 km.).

THE BEECHCRAFT MODEL 50 TWIN-BONANZA.

U.S.A.F. designation: L-23A.

A number of Twin-Bonanzas have been acquired by the U.S. Army Field Forces, under the designation L-23A, for staff transport duties.

TYPE.—Twin-engined six-seat Cabin monoplane.

WINGS.—Low-wing cantilever monoplane. All-metal structure. NACA slotted flaps.

FUSELAGE.—Metal structure with flush-riveted metal skin.

TAIL UNIT.—Cantilever monoplane type. Slight dihedral to tailplane. All-metal structure.

LANDING GEAR.—Retractable tricycle type. Main shock-strut assemblies interchangeable on either side. Nose wheel is steerable. Main wheel track 12 ft. 9 in. (3.88 m.). Wheelbase 10 ft. 9 in. (3.28 m.).

POWER PLANT.—Two 260 h.p. Lycoming G0-435-C2 six-cylinder horizontally-opposed air-cooled engines each driving a Beech Model B200-116 constant-speed, or Model 214-101 fully-feathering airscrew. Fuel capacity 134 U.S. gallons, 88 gallons in inboard wing tanks and 46 gallons in auxiliary outboard wing tanks.

ACCOMMODATION.—Enclosed cabin seating a maximum of six; pilot, co-pilot and passenger on front seat 54 in. (1.37 m.) wide and three passengers on rear seat 52 in. (1.32 m.) wide. Two baggage compartments one forward and one aft. A stretcher patient can be loaded through rear baggage door without need to climb on wing. Capacity of front baggage compartment 14 cub. ft. (0.4 m.³), rear compartment 41 cub. ft. (1.16 m.³). Equipment includes cabin



An impression of the Beechcraft T-36A Advanced Trainer.

sound-proofing, heating and ventilation, and choice of radio installations.

DIMENSIONS.—
Span 45 ft. 3⅜ in. (13.81 m.).
Length 31 ft. 6½ in. (9.61 m.).
Height 11 ft. 4 in. (3.45 m.).

WEIGHTS AND LOADINGS.—
Weight empty 3,800 lb. (1,700 kg.).
Weight loaded 5,500 lb. (2,500 kg.).
Wing loading 19.87 lb./sq. ft. (96.96 kg./m.²).
Power loading 11.46 lb./h.p. (5.21 kg./h.p.).

PERFORMANCE.—
Max. speed at 2,500 ft. (760 m.) 202.5 m.p.h. (324 km.h.).
Cruising speed (65% power) at 10,000 ft. (3,050 m.) 190 m.p.h. (304 km.h.).
Max. permissible speed 227 m.p.h. (365 km.h.).
Landing speed (full flaps) 64 m.p.h. (103 km.h.).
Rate of climb at S/L 1,500 ft./min. (456 m./min.).
Single-engine climb at S/L 310 ft./min (94 m./min.).
Service ceiling 19,000 ft. (5,780 m.).
Single-engine ceiling 9,000 ft. (2,745 m.).
Max. range (65% power) at 10,000 ft. (3,050 m.) 985 miles (1,580 km.).
Max. range (60% power) at 10,000 ft. (3,050 m.) 1,080 miles (1,728 km.).
Take-off to 50 ft. (15.25 m.) S/L. and no wind 448 yds. (409 m.).
Landing over 50 ft. (15.25 m.) no wind 405 yds. (370 m.).

THE BEECHCRAFT MODEL 45 MENTOR.

U.S.A.F. designation : T-34A.

The Model 45 Mentor has been inexpensively developed from the Bonanza as a two-seat primary trainer. The U.S.A.F. acquired three Model 45's under the designation YT-34 for general evaluation and test, as the result of which the Mentor has been selected as the new primary trainer for the U.S.A.F. under the designation T-34A.

Large contracts for the T-34A have been placed with the Beech Aircraft Corporation and with Beech's Canadian licensee, the Canadian Car and Foundry Co., Ltd. of Fort William, Ontario.

TYPE.—Two-seat Primary Trainer.

WINGS.—Low-wing cantilever monoplane. Same type structure as for the Bonanza. Ailerons and flaps of magnesium. Electrical flap operation. Wing area 177.6 sq. ft. (16.49 m.²).

FUSELAGE.—Metal structure with flush-riveted metal skin.

TAIL UNIT.—Conventional cantilever monoplane type. All-metal structure of magnesium. Adjustable trim-tabs in elevators and rudder.

LANDING GEAR.—Retractable tricycle type. Same as for Bonanza. Electric retraction with emergency hand control. Beech air-oil struts on all wheels. Goodyear wheels with single disc hydraulic brakes. Main wheel inboard doors close when wheels are down to keep out mud and dirt and to prevent buffeting damage. Nose-wheel is steerable and tyre has mud scraper to keep dirt off bottom of fuselage. Wheel track 9 ft. 7⅛ in. (2.94 m.).

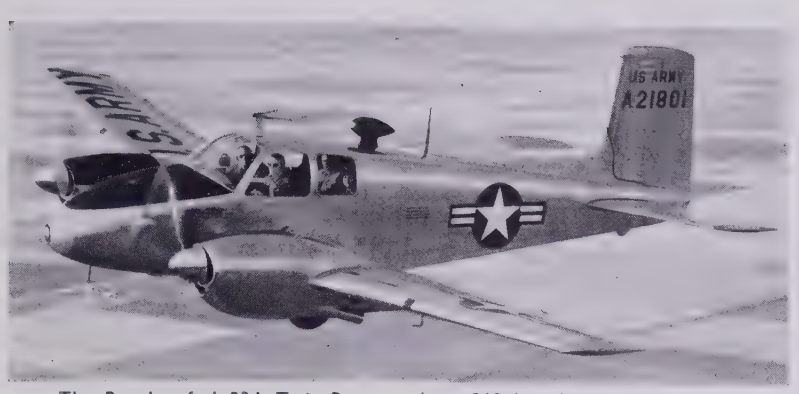
POWER PLANT.—One 225 h.p. Continental O-470-13 six-cylinder horizontally-opposed air-cooled engine. Beech Model 278-101 all-metal constant-speed airscrew 7 ft. 4 in. (2.23 m.) in diameter. Two wing fuel tanks. Capacity 50 U.S. gallons (225 litres). Oil capacity 2½ U.S. gallons (9.45 litres). Entire power-plant assembly including engine, airscrew, accessories and oil system, may be changed as a unit.

ACCOMMODATION.—Tandem cockpits under continuous transparent canopy with sections over each seat which may be independently opened or latched in intermediate positions. Conventional three-control system duplicated in each cockpit. Adjustable seats in both cockpits. Heating and ventilation. Windshield de-froster. Radio receiver, with range, reception and transmission. Baggage compartment aft of rear cockpit.

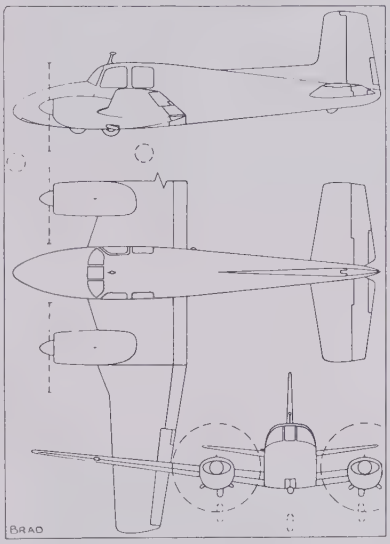
DIMENSIONS.—
Span 32 ft. 10 in. (10 m.).
Length 25 ft. 10 in. (7.8 m.).
Height (over tail) 9 ft. 7 in. (2.9 m.).

WEIGHTS AND LOADINGS.—
Weight loaded 2,900 lb. (1,317 kg.).
Wing loading 16.3 lb./sq. ft. (79.54 kg./m.²).
Power loading 12.9 lb./h.p. (5.85 kg./h.p.).

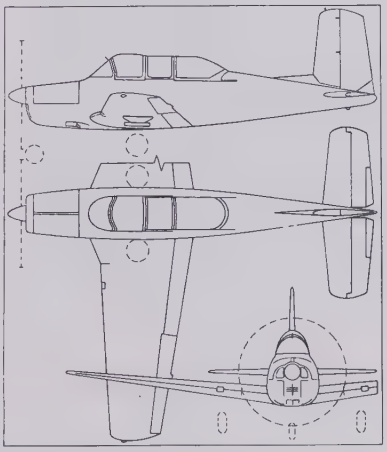
PERFORMANCE.—
Max. speed at S/L. 189 m.p.h. (302 km.h.).
Max. cruising speed 173 m.p.h. (277 km.h.). at 10,000 ft. (3,050 m.).
Stalling speed (flaps down) 53.5 m.p.h. (85.6 km.h.).
Service ceiling 20,000 ft. (6,100 m.).
Max. cruising range 975 miles (1,560 km.).
Take-off to 50 ft. (15.25 m.) no wind (10° full flaps) 1,030 ft. (314 m.).
Landing run from 50 ft. (15.25 m.) no wind (full flaps) 835 ft. (255 m.).



The Beechcraft L-23A Twin-Bonanza (two 260 h.p. Lycoming engines).



The Beechcraft Twin-Bonanza.


The Beechcraft Mentor.



The Beechcraft T-34A Mentor (225 h.p. Continental O-470 engine).

THE BEECHCRAFT MODEL D-35 BONANZA.

TYPE.—Four-seat Cabin monoplane.

WINGS.—Cantilever low-wing monoplane. Beech modified NACA 23000 series aerofoil section. All-metal structure. All-metal ailerons with fixed trim-tab in each. NACA slotted flaps between ailerons and fuselage. Wing area 177.6 sq. ft. (16.49 m.²).

FUSELAGE.—Metal structure with flush-riveted metal skin.

TAIL UNIT.—"Butterfly" type consisting of tailplane and elevators set at acute dihedral angle. Elevators act also as rudders. Balanced elevators with controllable trim-tab in each. Tailplane span 10 ft. 1⅝ in. (3.08 m.).

LANDING GEAR.—Retractable tricycle type. Beech air-oil shock struts. Doors close when wheels are in extended position. Track 9 ft. 7½ in. (2.93 m.). Goodyear wheels with single-disc hydraulic brakes. Goodyear nose-wheel on Beech air-oil strut, is steerable and has anti-shimmy device.

POWER PLANT.—One Continental E185-11 six-cylinder horizontally-opposed air-cooled engine rated at 185 h.p. at 2,300 r.p.m. at sea level and with 205 h.p. at 2,600 r.p.m. (2 min.) available for take-off. Beech B-215 two-blade electrically-controlled continuously variable-pitch airscrew, 7 ft. 4 in. (2.23 m.) diameter. Fuel capacity 39 U.S. gallons (148 litres) in two wing tanks. Optional auxiliary fuel tank (20 U.S. gallons = 75.6 litres) may be carried in baggage compartment. Oil capacity 2½ U.S. gallons (9.5 litres).

ACCOMMODATION.—Four-seat enclosed cabin. Two seats side-by-side in front, with orthodox throw-over dual controls. and full-width seat behind. Cabin dimensions 6 ft. 11 in. long × 3 ft. 6 in. wide × 4 ft. 2 in. high (2.11 × 1.07 × 1.27 m.). Access door 3 ft. × 3 ft. 1 in. (0.91 × 0.916 m.) on starboard side. Acrylic moulded windscreen and windows. Rear windows open for ground ventilation, and have release pins to permit their use as emergency exits. Cabin structure reinforced for protection in turn-over. Baggage compartment with capacity of 16.5 cub. ft.

(0.47 m.³) and allowance of 270 lb. (122.5 kg.) aft of seats. Access door 2 ft. × 1 ft. 10 in. (0.61 × 0.56 m.) on starboard side of fuselage.

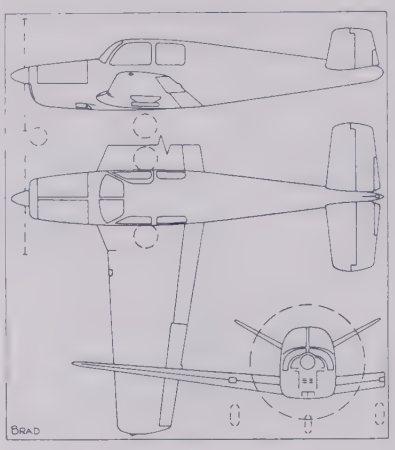
DIMENSIONS.
Span 32 ft. 10 in. (10 m.).
Length 25 ft. 2 in. (7.67 m.).
Height 6 ft. 6½ in. (2 m.).

WEIGHTS AND LOADINGS.-
Weight empty (fully-equipped) 1,650 lb. (750 kg.).
Useful load 1,075 lb. (488 kg.).
Pay-load with max. fuel 822 lb. (373 kg.).
Weight loaded 2,725 lb. (1,237 kg.).
Wing loading (fully loaded) 15.35 lb./sq. ft. (74.9 kg./m.²).
Power loading (fully loaded) 14.7 lb./h.p. (6.67 kg./h.p.).

PERFORMANCE.
Max. speed 190 m.p.h. (304 km.h.) at sea level.
Recommended cruising speed (120 h.p.) 175 m.p.h. (282 km.h.) at 8,000 ft. (2,440 m.).
Stalling speed at sea level (without flaps) 66 m.p.h. (106 km.h.).
With flaps at 30 degrees 55 m.p.h. (88 km.h.).
Rate of climb at sea level 1,100 ft./min. (335 m./min.).
Service ceiling 18,000 ft. (5,490 m.).
Max. range at 165 m.p.h. (264 km.h.) at 10,000 ft. (3,050 m.) 775 miles (1,240 km.).
Take-off run in 10 m.p.h. (16 km.h.) wind at sea level 525 ft. (160 m.).
Landing run in 10 m.p.h. (16 km.h.) wind at sea level 227 ft. (69 m.).



The Beechcraft Bonanza (250 h.p. Continental E185 engine).



The Beechcraft Bonanza.

THE BEECHCRAFT MODEL D18S.
U.S.A.F. designation: C-45.
R.C.A.F. name: Expeditor.

TYPE.—Twin-engined Light Transport.

WINGS.—Low-wing cantilever monoplane. All-metal structure with a smooth skin covering flush-riveted over leading-edge. Duralumin-framed ailerons and flaps, with fabric covering. Trimming-tab in left aileron. Electrical flap operation. Wing area 349 sq. ft. (32.4 m.²).

FUSELAGE.—Metal structure covered with a smooth skin, flush-riveted on the nose section.

TAIL UNIT.—Monoplane type with twin fins and rudders. Stressed-skin tailplane and fins. Rudder and elevators have aluminium-alloy frames with fabric covering. Trimming-tabs on both rudders and on each half of elevator.

LANDING GEAR.—Retractable tail-wheel type. Electric actuation. Beech air-oil shock-absorbers. Low-pressure wheels and hydraulic brakes of the single-disc ventilated type with controls for both pilot and co-pilot.

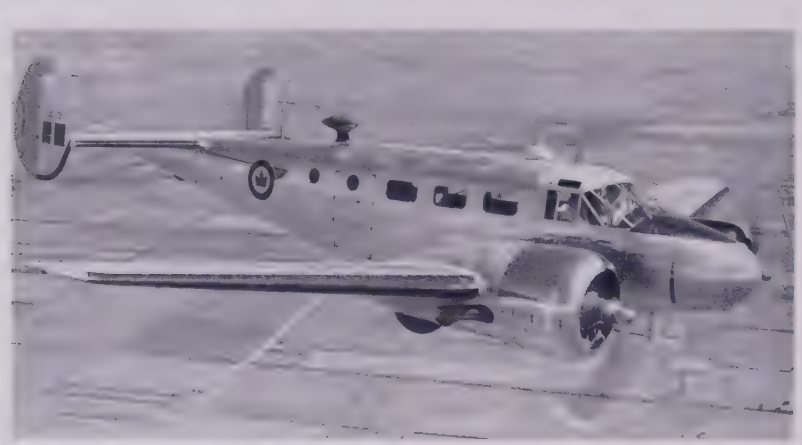
POWER PLANT.—Two 450 h.p. Pratt & Whitney R-985-B5 Wasp Junior radial air-cooled engines. Hamilton-Standard Hydromatic constant-speed airscrews 8 ft. 3 in. (2.51 m.) in diameter. Normal tankage in wings with total capacity 206 U.S. gallons (780 litres). Additional long-range tank may be installed in nose of fuselage in place of baggage compartment. Capacity of nose tank 80 U.S. gallons (302 litres).

ACCOMMODATION.—Pilot's compartment in nose, seating two side-by-side, with dual controls. Passenger cabin seats five to seven passengers. Baggage compartments in extreme nose and behind cabin. Soundproofing, controlled ventilation and heating.

DIMENSIONS.—
Span 47 ft. 7 in. (14.5 m.).
Length 33 ft. 11½ in. (10.4 m.).
Height 9 ft. 2½ in. (2.8 m.).

WEIGHTS AND LOADINGS. -
Weight empty 5,770 lb. (2,620 kg.).
Weight loaded 8,750 lb. (3,980 kg.).
Wing loading 25.1 lb./sq. ft. (122.4 kg./m.²).
Power loading 10.92 lb./h.p. (4.96 kg./h.p.).

PERFORMANCE. -
Max. speed 230 m.p.h. (370 km.h.) at 5,000 ft. (1,525 m.).
Cruising speed 211 m.p.h. (338 km.h.) at 10,000 ft. (3,050 m.).
Stalling speed 77 m.p.h. (123 km.h.).
Rate of climb 1,190 ft./min. (363 m./min.).
Climb on one engine 225 ft./min. (68.6 m./min.).
Service ceiling 20,500 ft. (6,250 m.).
Range (normal—no reserve) 1,125 miles (1,585 km.).
Max. range (with nose tank—no reserve) 1,500 miles (2,400 km.).
Take-off to 50 ft. (15.25 m.) no wind 1,760 ft. (537 m.).
Landing distance from 50 ft. (15.25 m.) no wind 1,460 ft. (445 m.).



A Beechcraft D18S Expeditor as supplied to the Canadian Government as a navigation and multi-engine pilot trainer.

BEECRAFT
BEECRAFT ASSOCIATES, INC.

HEAD OFFICE: 1536 MISSOURI STREET, SAN DIEGO 9, CALIFORNIA.

President: William F. Chana.

Vice-President—Engineering: K. S. Coward.

The founders of Beecraft Associates, Inc., were responsible for the Wee Bee monoplane, which was claimed to be big enough to lift a man yet small enough to be lifted by one. The Wee Bee, which was demonstrated in the United States and England two years ago, was notable for the fact that the pilot lay prone on the fuselage.

Beecraft has now produced the Honey Bee monoplane, which flew for the first time on July 12, 1952.

Under development are a small single-seat helicopter, a target drone, a medium-range twin-engined light transport and a small jet-driven delta-wing research aircraft for prone-position experimentation.

THE BEECRAFT HONEY BEE.

TYPE. Single-seat light monoplane.

WINGS.—High-wing cantilever monoplane. NACA 4418 (modified) wing section. Aspect ratio 8.17. All-metal monospar stressed-skin structure. Aileron area 5.35 sq. ft. (0.49 m.²) each. Gross wing area 96 sq. ft. (8.92 m.²).

FUSELAGE.—All-metal stressed-skin structure.

TAIL UNIT.—45° "Butterfly" type. NACA 0012-64 (modified) aerofoil section. Stabiliser area 12.5 sq. ft. (0.116 m.²) total. Elerudder area 12.5 sq. ft. (0.116 m.²) total.



The Beecraft Honey Bee (65 h.p. Continental A65 engine).

LANDING GEAR.—Fixed nose-wheel type. Cantilever spring steel main legs. Steerable nose-wheel. Main wheel track 6 ft. 8 in. (2.03 m.). Wheelbase 4 ft. 4½ in. (1.33 m.).
POWER PLANT.—One 65 h.p. Continental A65 four-cylinder horizontally-opposed air-cooled engine. Two-blade Flothorp fixed-pitch airscrew, 5 ft. 6 in. (1.67 m.) diameter.
ACCOMMODATION.—Enclosed cabin for pilot below wing.

DIMENSIONS.—
Span 28 ft. (8.54 m.).
Length 16 ft. 10 in. (5.13 m.).
Height 7 ft. 8 in. (2.34 m.).
WEIGHTS AND LOADINGS.—
Weight empty 610 lb. (277 kg.).
Weight loaded 860 lb. (390 kg.).
Wing loading 8.95 lb./sq. ft. (43.67 kg./m.²).
Power loading 13.25 lb./h.p. (6.0 kg./h.p).

PERFORMANCE.—Max. speed 120 m.p.h. (192 km.h.).
Cruising speed 110 m.p.h. (176 km.h.).
Stalling speed (power off) 45 m.p.h. (72 km.h.).
Initial rate of climb 1,000 ft./min. (305 m./min.).
Service ceiling 15,000 ft. (4,575 m.).
Range 240 miles (384 km.).

BELL

BELL AIRCRAFT CORPORATION.

HEAD OFFICE: P.O. Box 1, BUFFALO 5, N.Y.

WORKS: NIAGARA FALLS, N.Y.

TEXAS (HELICOPTER) DIVISION: FORT WORTH, TEXAS.

President and General Manager: Lawrence D. Bell.

Assistant General Manager: Leston P. Faneuf.

First Vice-President: Ray P. Whitman.

Vice-President—Manufacturing: Julius J. Domonkos.

Vice-President—Helicopters: Harvey Gaylord.

Vice-President—Engineering: Roy J. Sandstrom.

Secretary and Treasurer: Leston P. Faneuf.

The Bell Aircraft Corpn. was formed in 1935 by Lawrence D. Bell, formerly Vice-President and General Manager of the Consolidated Aircraft Corpn., R. P. Whitman, who was Assistant General Manager of Consolidated, and Robert J. Woods, Consolidated's Chief Engineer. When Consolidated moved its factory from Buffalo to San Diego, Cal., these three men remained in Buffalo to form the new company.

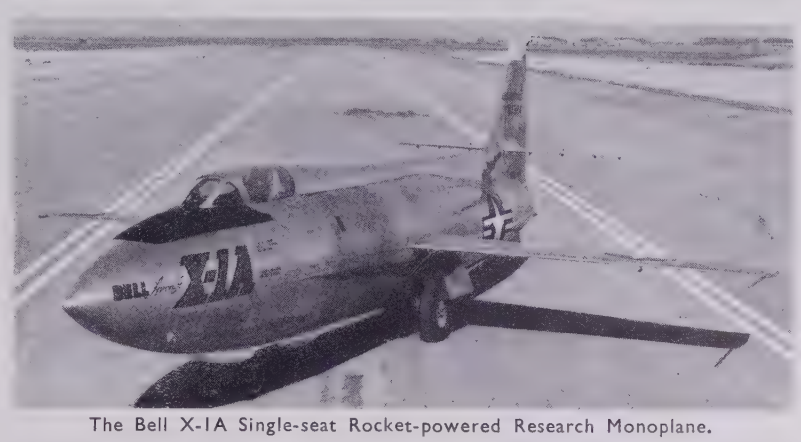
Bell was early in the field in helicopter development. Following two years' development work, an experimental Model 30 was flying in 1943, and this craft was superseded late in 1945 by the first of the Model 47 Series. This helicopter received the first helicopter Approved Type Certificate from the C.A.A. on May 8, 1946. The Model 47 has been in continuous production in both military and commercial forms since 1946.

Helicopter output at Fort Worth, Texas, in 1952 exceeded that of all other rotary-wing aircraft manufacturers. Production involved mainly the Model 47 and the XHSL-1 for the U.S. Navy, and experimental and development work proceeded with various craft of advanced design.

Bell is currently developing high-speed high-lift rotors of advanced design and is also engaged in an extensive programme of helicopter research, including methods of rotor de-icing.

THE BELL X-1.

The X-1 was designed jointly by Bell, the U.S.A.F. and the N.A.C.A. specifically to investigate supersonic flight problems. It is powered by a Reaction Motors bi-fuel rocket motor capable of developing a maximum static thrust of 6,000 lb. (2,722 kg.) for 2½ minutes.



The Bell X-1A Single-seat Rocket-powered Research Monoplane.

The X-1 was first airborne in 1946 when it was carried to altitude by a Boeing B-29, released, and allowed to glide to earth. Its first flight under its own power took place over the Muroc Flight Test Base in California on December 9, 1946, after being dropped from a B-29. The X-1 first exceeded Mach. 1 on October 14, 1947. On January 5, 1949, the X-1 took off under its own power for the first time and climbed to 23,000 ft. (7,015 m.) in 1 minute 40 seconds.

Of the two X-1's built, the first has now been retired and lodged in the National Air Museum of the Smithsonian Institution. The second is still being flown for research purposes by the NACA.

Three improved models with a turbo-pump fuel system in place of the pressurised system used in the X-1, and with greater fuel capacity, have been built, but one, the X-1D, was destroyed in August, 1951, when it was jettisoned from a B-50 carrier over the Edwards A.F.B., Muroc, following an explosion. There were no casualties. The two other aircraft, the X-1A and X-1B, have been delivered to the U.S.A.F.

A full structural description of the X-1 has been published in previous issues of "All the World's Aircraft."

THE BELL X-2.

The X-2 supersonic research monoplane had sweptback wings and tail of stainless steel, a K-Monel metal fuselage, and was powered by a Curtiss XLR-25 rocket motor, the first of its kind to have throttle control.

In May, 1953, the Bell X-2, while being carried to altitude by a B-50 carrier, was damaged by an internal explosion, probably while being fueled, and was dropped or fell away. The pilot of the X-2 and one other person were killed in the B-50 by the explosion.

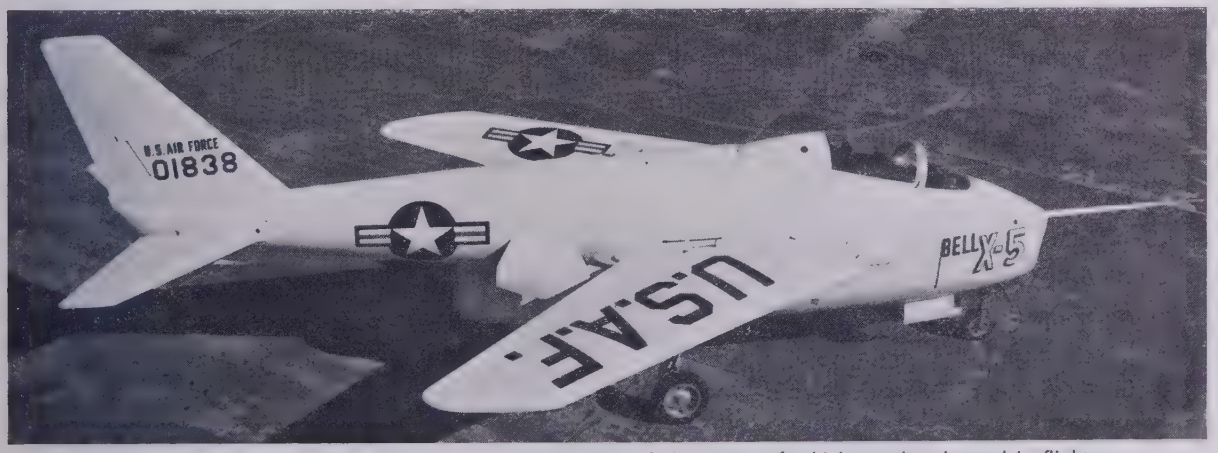
THE BELL X-5

The X-5 is a single-seat research monoplane which will be used by the NACA to investigate the aerodynamic effects of changing the degree of wing sweepback during flight.

The X-5 is powered with an Allison J35-A-17 turbojet engine (4,900 lb.= 2,680 kg. s.t.) which is mounted aft and below the pilot's cockpit. The nose air inlet duct passes under the pilot's cockpit to the engine.

The wings have variable sweepback, the operating mechanism compensating for the resultant shift of the centre of gravity. Each wing root has a specially designed fairing to ensure that the root leading-edge and trailing-edge present a smooth aerofoil surface regardless of the angle of sweepback. Full-span leading-edge slats are fitted.

Hydraulically-operated dive brakes are located in the sides of the fuselage forward of the cockpit. These are in the form of metal "doors" which may be opened to positions at nearly right angles to the fuselage.



The Bell X-5 Research Monoplane, the sweepback of the wings of which can be changed in flight.

All three wheels of the tricycle landing-gear retract into the fuselage.

The cockpit ahead of the wings is both pressurised and air-conditioned. Both the canopy and pilot's seat are jettisonable in emergency by means of cordite cartridge type cylinders.

DIMENSIONS.
Span: (normal) 32 ft. 9 in. (10.0 m.).
Length: 32 ft. 4 in. (10.16 m.).
Height: (over fin) 12 ft. (3.66 m.).

WEIGHT.—
Loaded (approx.): 10,000 lb. (4,540 kg.).

PERFORMANCE.—
No data available.

THE BELL MODEL 47 HELICOPTER.

U.S.A.F. designations: H-13B (47D), H-13D, H-13E (47-D-1) and H-13G (47G).

U.S. Navy designations: HTL-1 (47B), HTL-2, HTL-3 (47D), HTL-4 and HTL-5 (47-D-1), and HTL-6 (47G).

Since it delivered its first Model 47 in January, 1947, Bell has produced five commercial models. They are the 47B, which had an enclosed, automobile-type cabin; the 47B-3, which had an open cockpit; the 47D, which had an all-Plexiglas cabin for greater visibility, plus weather protection, the 47D-1, and the 47G, the company's newest model. There have been corresponding military and naval versions to most of these models.

Since the delivery of the first commercial Model 47 in December, 1946, more than 600 Bell helicopters have been bought by commercial operators in the United States and abroad and by the U.S. armed forces.

Bell commercial helicopters have been used effectively to dust and spray agricultural crops for weed and pest control, to conduct power-line, forestry, pipe-line, geological and geophysical surveys, to aid in fighting forest fires, to carry airmail and to fulfil a variety of other aerial tasks for which they are especially suited.

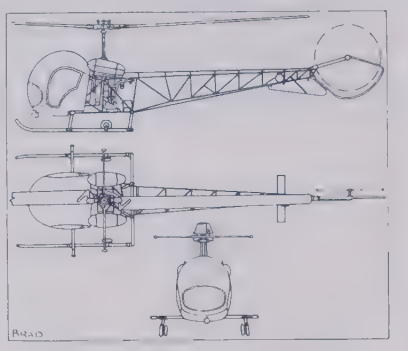
The versatile usefulness of the helicopter has been emphasised by the performance of rotary-wing aircraft in Korea. They have been used for liaison, cable-laying, transport and a wide variety of purposes. But its most dramatic rôle has been that of aerial ambulance, evacuating wounded U.N. troops from the front lines to mobile hospitals several miles to the rear.

In 1951 and 1952, Bell H-13D and HTL-4 helicopters, flown by Army and Marine pilots respectively, evacuated over 12,000 casualties, most of them with serious injuries.

The latest version of the Model 47 is the 47G, deliveries of which began in June, 1953. This model has several improvements, including a small elevator which is geared to work in conjunction with rotor tilt. This permits an increase in permissible C.G. travel and greatly improves stability.



The Bell Model 47G Helicopter (200 h.p. Franklin engine).



The Bell Model 47G Helicopter.

In April, 1953, the 1,000th Model 47 was completed and delivered.

TYPE.—Three-seat General Utility Helicopter (47D-1).

ROTORS.—Two-blade main rotor and controllable-pitch anti-torque rotor. Main rotor hub mounted on transmission mast by universal joint and provided with a stabilizing bar below and at right angles to the blades. A swash-plate revolving with the mast but free to move up and down provides cyclic pitch-control. Lower half of swash-plate which does not revolve alters pitch of the blades differentially for directional control. Main rotor drive through a centrifugal clutch and a two-stage planetary transmisson with a 9 : 1 reduction ratio. Free-wheeling mechanism incorporated in transmission. Transmission furnishes power take-offs for tail rotor drive, cooling fan and accessories and pulleys. Main rotor blades of symmetrical aerofoil section, are of laminated wood with a steel insert in leading-edge for strength and mass-balance. Blade area (each) 17.67 sq. ft. (1.64 m.²). Disc area 965 sq. ft. (89.65 m.²). Pre-coning angle 2.5 degrees. Anti-torque rotor blade likewise of laminated wood. Blade area (each 1.2 sq. ft. (0.11 m.²). Disc area 25.31 sq. ft. (2.35 m.²).

FUSELAGE.—In three sections; centre, tail and cabin. Centre section has a welded tubular steel framework which provides for mounting the engine and supports the cabin. Rear section is also a tubular structure, is triangular in cross-section and serves as a support for the anti-torque rotor drive-shaft.

LANDING GEAR.—Tubular skid type. Skid tread 7 ft. 6 in. (2.28 m.). Four-wheel landing-gear may be supplied for training and other missions requiring considerable handling. The two forward self-castoring wheels capable of swivelling through 360°, the two rear wheels fixed. Wheel track 5 ft. 10½ in. (1.78 m.). For amphibious use two air-inflated nylon floats are easily attached.

POWER PLANT.—One vertically-mounted 200 h.p. Franklin 6V4-200-C32 (0-355-5) six-cylinder horizontally-opposed fan-cooled engine with clutch, drive shaft and rotor assembly in an integral unit in a steel-tube framework with the engine supported in rubber mounts at the top and bottom and attached to the welded framework of the forward fuselage. The engine-mounting structure has three attachment points for the rear fuselage. Engine controls include throttle, carburettor, hot air and carburettor mixture. The throttle is located on the main rotor pitch control lever and drives through a cam which automatically compensates for varying power requirements as the main rotor pitch control lever is actuated.

ACCOMMODATION.—Side-by-side seating for three in enclosed compartment. The compartment is covered by a full-blown Plexiglas canopy with doors attached. For fair weather or specialised operations the doors are quickly removable.

CONTROLS.—Conventional control stick for tilting main rotor by cyclic rotor blade angle change. Adjustable friction device on stick used to regulate control sensitivity. Main rotor pitch control lever located at left side of each seat. Rudder pedals connected to pitch-changing mechanism on tail rotor for torque compensation and directional control.

EQUIPMENT.—Full instrumentation, 24-volt electrical system, radio, and full wiring for night-flying. Accessories available in kit form include litter/cargo platforms, flotation gear, wheel landing-gear, air-mail and package delivery containers, agricultural dusting, fogging and spraying equipment, engine silencers, night flying equipment, etc.

DIMENSIONS.—
Diameter of main rotor 35 ft. 1½ in. (10.72 m.).
Overall length (main rotor fore-and-aft) 41 ft. 2½ in. (12.58 m.).
Length of fuselage (tail rotor vertical) 27 ft. 4 in. (8.33 m.).
Width (over torsion bar) 8 ft. 6 in. (2.59 m.).
Height 9 ft. 2 in. (2.79 m.).
Diameter of tail rotor 5 ft. 8 in. (1.72 m.).



The Bell H-13D Helicopter with skid landing-gear. (*Harold Martin*).

WEIGHTS AND LOADINGS.—
Weight empty 1,380 lb. (526 kg.).
Weight loaded 2,350 lb. (1,067 kg.).
Disc loading 2.4 lb./sq. ft. (11.71 kg./m.²).
Power loading 11.75 lb./h.p. (5.33 kg./h.p.).

PERFORMANCE.—
Max. cruising speed at sea level 98 m.p.h. (157 km.h.).
Operating speed (75% power) 78 m.p.h. (125 km.h.).
Max. rate of climb at sea level 920 ft./min. (281 m./min.).
Vertical rate of climb 400 ft./min. (122 m. min.).
Service ceiling 11,000 ft. (3,355 m.).
Hovering ceiling (in ground effect) 8,500 ft. (2,590 m.).
Range (75% power) 170 miles (272 km.) or 2.3 hours.

THE BELL MODEL 48 HELICOPTER.
U.S. Air Force designation: YH-12.

The Model 48 is a eight/ten-seat General Utility helicopter which has been designed and built for the U.S.A.F. Three XH-12 (one for static test) and eleven YH-12B's have been built.

Tactical missions for this helicopter, as prescribed by the U.S.A.F., include personnel evacuation, cargo transport, observation, liaison, general co-operation with ground forces, assisting in locating suitable objectives, adjusting fire and general investigation of other potentialities.

Alternative equipment which the H-12 has been designed to carry includes flotation gear for water operation, rescue hatch and hoist, Army canvas litters, Naval Stokes litters (a metal framed wire-protected litter of larger dimensions and greater comfort) and life rafts. The crew may consist of two, plus eight passengers in transport version or crew of one plus six litters and attendant in emergency rescue or evacuation duties.

The H-12 is virtually a scaled-up version of the Model 47 and incorporates the same basic rotor system. The powerplant consists of a Pratt & Whitney R-1340-55 Wasp engine of 600 h.p. The landing-gear is of the quadricycle type.

DIMENSIONS.—
Main rotor diameter 47 ft. 6 in. (14.48 m.).
Anti-torque rotor diameter 8 ft. 6 in. (2.59 m.).

WEIGHTS.—
Weight empty 4,200 lb. (1,910 kg.).
Disposable load 2,400 lb. (1,090 kg.).
Weight loaded 6,600 lb. (3,000 kg.).

PERFORMANCE.—
Max. speed 105 m.p.h. (168 km.h.).
Cruising speed 85 m.p.h. (136 km.h.).
Max. rate of climb 1,000 ft./min. (305 m./min.).
Vertical rate of climb 400 ft./min. (122 m./min.).
Service ceiling 10,000 ft. (3,050 m.).
Hovering ceiling 4,350 ft. (1,330 m.).
Range 400 miles (640 km.).



The Bell HTL-4 Helicopter with the normal four-wheel landing-gear.

THE BELL MODEL 54 HELICOPTER.
U.S. Air Force designation : XH-15.

This helicopter has been designed for the U.S.A.F. It is of all-metal construction and uses the same basic rotor system employed in other Bell models.

It is a two-seat model and will be used for high-altitude observation, liaison, photographic work and communication. This helicopter has a top speed of more than 100 m.p.h. (160 km.h.), an absolute ceiling of 20,000 ft. (6,100 m.) and a combat radius of 200 miles (320 km.).

Its two-bladed rotor system has a diameter of 37 ft. 4 in. (11.38 m.) and the overall length of the helicopter, including the rotor, is 44 ft. 9 in. (13.65 m.). The design gross weight is 2,777 lb. (1,260 kg.). The engine is a 275 h.p. Continental O-470-5.

Still in an experimental classification, Bell has built three for the U.S.A.F.

THE BELL MODEL 61.
U.S. Navy designation: XHSL-1.

The XHSL-1 is a large tandem-rotored helicopter which has been designed specifically for anti-submarine warfare. An initial contract for three was awarded to Bell immediately after the design was successful in winning a U.S. Navy anti-submarine helicopter competition in June, 1950.

The tandem-rotored XHSL-1 marks the Bell company's first departure from its familiar single-rotor configuration which has been used in all Bell helicopters since 1942. Each of the two rotors incorporates the basic Bell rotor principles, characterised by the rigid two-blade rotor and automatic stabilising bar. The fore and aft rotors are interconnected and power is supplied by a Pratt & Whitney R-2800 engine in a buried installation. The rotors can be folded to enable the helicopter to negotiate the elevators in aircraft-carriers or other type of ship.

The general characteristics of the XHSL-1, which made its first flight on March 4, 1953, can be vouchsafed from the accompanying illustration. No further details were available for publication at the time of writing.

THE BELL MODEL 200 CONVERTAPLANE.

Bell has been awarded a contract to develop a convertaplane which will combine rotary-wing advantages with those of a conventional fixed-wing aircraft. It will be powered by a Pratt & Whitney R-2800 radial air-cooled engine. Details and data are not available.



The Bell XHSL-1 Helicopter (Pratt & Whitney R-2800 engine).

BELLANCA

BELLANCA AIRCRAFT CORPORATION.

HEAD OFFICE, WORKS AND AERODROME: BELLANCA AIRPORT, NEW CASTLE, DELAWARE.

Established: December 30, 1927.

President: G. M. Bellanca.

Assistant to President: John Bellanca.

General Manager: N. F. Vanderlipp.

Executive Engineer: Bruno J. Salvadori.

Secretary: Marion Graf.

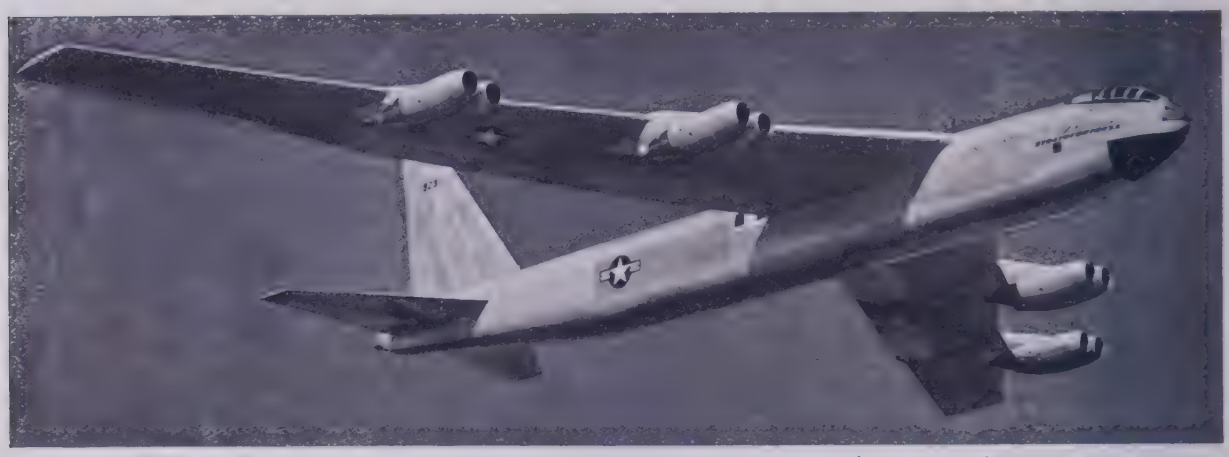
Treasurer: A. F. Baldini.

The Bellanca Aircraft Corporation was incorporated on December 30, 1927, taking over the old Bellanca Aircraft Corporation of America.

Since the war the Bellanca company has built the Model 14-13-3 Cruisair and the Model 14-19 Cruisemaster, both four-seat cabin monoplanes of conventional low-wing design. They have both been fully described and illustrated in previous editions of "All the World's Aircraft."

The company is at present devoting its principle activities to the manufacture of parts and components under sub-contract to other companies engaged in the defence programme.

BOEING



The Boeing YB-52 Stratofortress (eight Pratt & Whitney J57 turbojet engines).

THE BOEING AIRPLANE COMPANY.

HEAD OFFICE: SEATTLE 14, WASH.

AIRCRAFT MANUFACTURING DIVISIONS: SEATTLE, WASH., AND WICHITA, KANSAS.

Established: July, 1916.

Chairman: C. L. Egtvedt.

President: William M. Allen.

Senior Vice-President: Wellwood E. Beall.

Vice-President in charge of Engineering: Edward C. Wells.

Vice-President in charge of Manufacturing: F. P. Laudan.

Vice-President in charge of Industrial Relations: A. F. Logan.

Vice-President and Sales Manager: F. B. Collins.

Vice-President and Controller: J. O. Yeasting.

Vice-President in charge of Administration: J. E. Prince.

Vice-President and Eastern Representative: J. P. Murray.

Controller, Seattle Division: E. M. Nelson.

Chief Engineer: L. A. Wood.

WICHITA DIVISION.

Vice-President and General Manager: J. E. Schaefer.

Vice-President in charge of Manufacturing: C. B. Gracey.

Vice-President and Division Controller: Clif Barron.

Assistant to Vice-President and General Manager: L. M. Divinia.

Chief Engineer: N. D. Showalter.

In 1951 the Boeing Airplane Company was engaged in production of the B-47 Stratojet six-jet bomber; the C-97 Stratofreighter military transport and was entering into production with the B-52 eight-jet heavy bomber.

A prototype jet transport is being built for demonstration to the armed forces and the airlines in 1954. It will be powered by four jet engines suspended from the swept wings in Boeing-type pods and will have a cruising speed of over 500 m.p.h. (800 km.h.).

The B-47, for which large production contracts are in hand, is being manufactured at the Wichita Division plants, where its production is the subject of one of the most widespread sub-contracting programmes in the American rearmament effort. More than 300 B-47's had been built in Wichita by the end of 1952.

The Douglas Aircraft Company has re-occupied the government-owned plant which it operated in World War II at Tulsa, Oklahoma, for production of the Boeing B-47. The Government-owned plant at Marietta, Georgia, which was operated by Bell during the last war for the production of the B-29, has been re-activated by Lockheed for additional B-47 production. In addition, a B-47 modification centre has been opened at Tucson, Arizona, by Grand-Central Aircraft.

The C-97 is in production in the Government-owned and Boeing-operated plant at Renton, Wash., near Seattle. All C-97's now being manufactured are equipped for air refuelling. The last TB-50H Superfortress was delivered from



The Boeing YB-52 Stratofortress (eight Pratt & Whitney J57 turbojet engines).



The Boeing XB-52 Stratofortress (eight Pratt & Whitney J57 turbojet engines).

Renton to the U.S.A.F. on February 26, 1953.

Boeing's guided missile programme is one of the largest projects in the company's engineering department and continues to increase in importance, but no details have been made public.

At the beginning of 1953 employment in the various Boeing plants totalled approximately 55,000.

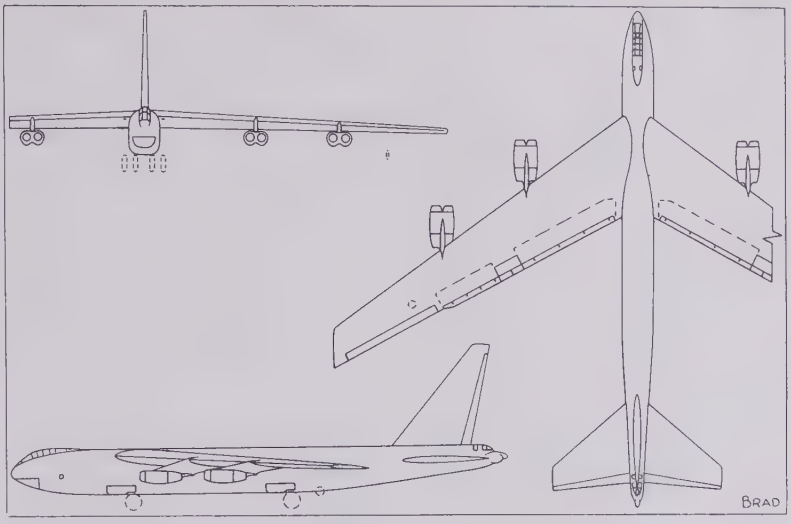
THE BOEING MODEL 707.

The Model 707, for some time known as Project X, will be the first American jet transport to fly in prototype form, the first flight being due to take place in the Summer or Autumn of 1954. The aircraft is being built by Boeing as a private venture and with both civil and military purposes in mind. While the prototype is being built primarily as an airliner to carry 80 to 100 first-class, and up to 130 tourist-class passengers, the aircraft is also being engineered to meet military requirements as a high-speed transport or tanker, and Boeing is hoping for a military order to help towards underwriting the tooling-up and development of a full-scale jet airliner programme.

Basically the Model 707 will be a swept wing monoplane which will be powered by four Pratt & Whitney JTL3 (J57) turbojet engines (11,000 lb.=4,995 kg. s.t. with water injection each) installed in four separate and interchangeable pods suspended beneath the wings. The wings will have the same 35° sweep as the B-47 and B-52 and a swept tail-unit and tandem dual-wheel landing-gear with outrigged stabilising wheels will also conform generally to those of the B-47.

The oval double-deck fuselage will have the main passenger accommodation on the upper deck with the lower deck reserved for baggage and freight.

DIMENSIONS (Provisional).—
Span 130 ft. (39.65 m.).



The Boeing B-52 Stratofortress Heavy Bomber.

Length 127 ft. 10 in. (38.99 m.).
Height (over fin) 38 ft. 3 in. (11.66 m.).
WEIGHTS (Designed).—
Tare weight 88,890 lb. (40,356 kg.).
Weight empty equipped 92,120 lb. (41,822 kg.).
Payload 25,000 lb. (11,350 kg.).
Weight loaded 190,000 lb. (86,260 kg.).
PERFORMANCE.—
No data available.

THE BOEING STRATOFORTRESS.

U.S. Air Force designation: B-52.

The B-52 is an eight-jet swept-wing long-range heavy bomber which has been ordered into production for the U.S.A.F. and is in its initial quantity production stages at the Seattle plant.

Two prototypes, the XB-52 and YB-52, were built, the YB-52 flying for the first time on April 15, 1952, while the XB-52 made its maiden flight on October 2, 1952.

Although the B-52 is a completely different aircraft from the B-47 insofar as both design and mission are concerned, outwardly the two aeroplanes are somewhat similar in appearance. Both feature a 35-degree angle of wing sweepback, distinctive Boeing-type external jet engine pods and a tandem landing-gear. The B-52 landing-gear is, however, a double side-by-side tandem, with small single outrigged wing-tip "protection" wheels which do not normally come into contact with the ground.

The B-52 is powered by eight Pratt & Whitney J57 turbojet engines which are mounted in pairs in suspended pods, two pairs on each side of the fuselage.



This view of the Boeing XB-52 coming in to land at the Edwards AFB, Muroc Lake, shows how the wings flex under heavy air loads.



The Boeing B-47B Medium Bomber (six General Electric J47 turbojet engines).

All other details of the B-52 are classified.

DIMENSIONS.
Span 185 ft. (56.42 m.).
Length 153 ft. (46.66 m.).
Height over tail 48 ft. (14.64 m.).

THE BOEING STRATOJET.
U.S. Air Force designation : B-47.

The XB-47 was the first large jet-propelled aircraft to be fitted with sweptback wings and tail surfaces. Two prototypes were built, the first flying for the first time on December 17, 1947, and the second on July 21, 1948.

XB-47. Two prototypes, both originally fitted with General Electric J35 engines (4,000 lb.=1,816 kg.). In 1949 first prototype re-engined with J47 engines (5,200 lb.=2,360 kg. s.t.). Re-engined XB-47 flew for first time on October 7, 1949.

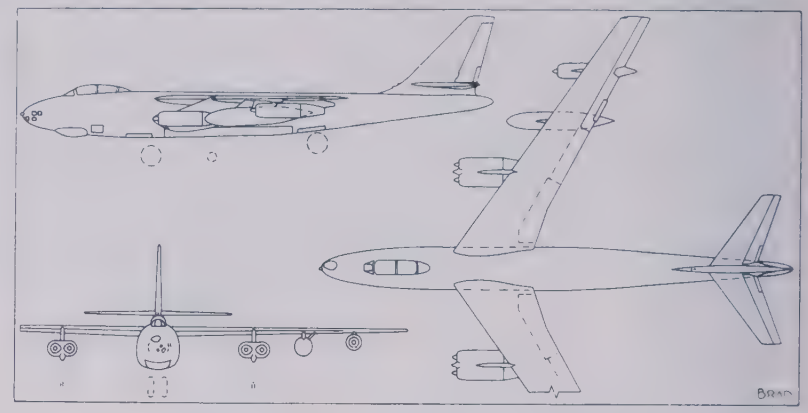
B-47A. Six General Electric J47-GE-11 engines (5,200 lb.=2,360 kg. s.t.). 18 individual Jato solid-fuel rockets fitted to give emergency take-off thrust of 20,000 lb. (9,080 kg.). First production B-47A completed March 1, 1950.

B-47P. Six General Electric J47-GE-23 engines (5,800 lb.=2,630 kg. s.t.). Gross weight 185,000 lb. (84,000 kg.). Fitted with wing drop tanks. In production at Wichita (Boeing), Tulsa (Douglas) and Marietta (Lockheed).

KB-47B. Tanker modification of B-47B. Uses an adaptation of Flight Refuelling "probe-and-drogue" system installed in bomb-bay. Still under test by U.S.A.F.

RB-47B. Conversion of B-47B for high-altitude photographic reconnaissance. Eight cameras and equipment in heated "package" can be installed in and removed from bomb-bay.

XB-47C. Development aircraft to be fitted with four Allison J71 engines. No further data.



The Boeing B-47B Stratojet Medium Bomber.

XB-47D. Experimental project. No data available.

B-47E. Developed version of B-47B, which it is following on production lines. A revision of tail armament will be noticeable in illustration below. No further details.

RB-47E. Day or night long-range photographic reconnaissance aircraft in production at Wichita. Longer nose. Heated and air-conditioned camera compartment. Crew of three, pilot, co-pilot and photographer-navigator.

The description which follows refers to the B-47B.

TYPE.—Six-jet Medium Bomber.

WINGS.—Shoulder-wing cantilever monoplane with anhedral and 35 degree sweepback. Thin laminar-flow wing section. All-metal stressed-skin structure.

FUSELAGE.—Oval-section all-metal structure with flush-riveted stressed-skin covering.

TAIL UNIT.—Cantilever monoplane type. All-surfaces swept-back. All-metal structure.

LANDING GEAR.—Retractable tandem type. Two main twin-wheel units in tandem retracting forward into fuselage fore and aft of bomb-bay. Small outrigger wheel units retract into inboard engine nacelles.

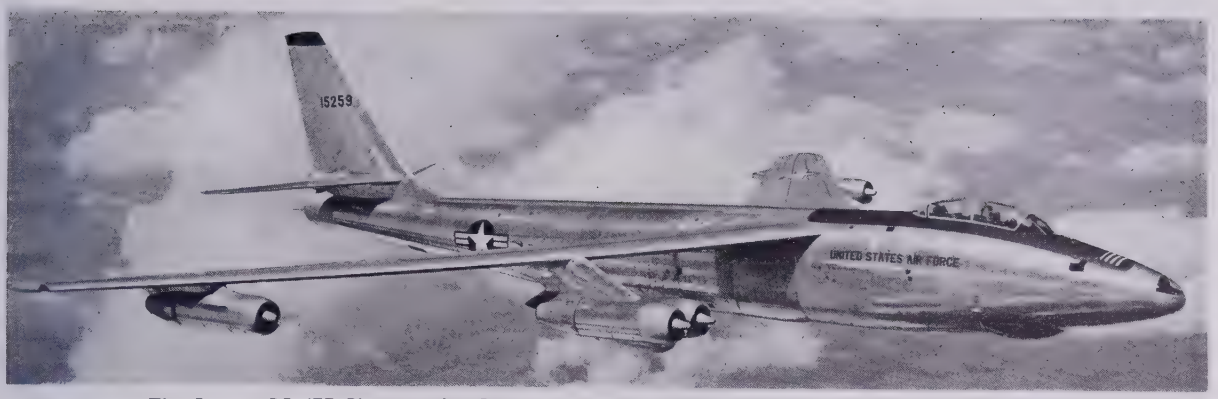
POWER PLANT.—Six General Electric J47 turbojet engines, four paired in two nacelles supported on forwardly-inclined cantilever struts under inner wings and two in single nacelles under outer wings near tips. Auxiliary take-off power provided by rocket motors built into sides of fuselage aft of wings. Total emergency thrust 20,000 lb. (9,080 kg.). All production B-47's have provision for flight re-fuelling, using Boeing "Flying Boom" system.

ACCOMMODATION.—Crew of three. Pilot and co-pilot in tandem under bubble-type canopy. Bombardier in nose. Catapult-type ejection seats for all crew members. Entire crew accommodation forward of wings pressurised and temperature-controlled.

ARMAMENT.—Remotely-controlled tail armament only. No details available.



The Boeing B-47E Medium Bomber (six General Electric J47 turbojet engines).



The Boeing RB-47E Photographic Reconnaissance Monoplane (six General Electric J47 engines).

Designed internal bomb load 20,000 lb. (9,080 kg.).

DIMENSIONS.—
Span 116 ft. (35.4 m.).
Length 108 ft. (32.9 m.).
Height (over tail) 28 ft. (8.5 m.).

DESIGNED LOADED WEIGHT.—
185,000 lb. (84,000 kg.).

PERFORMANCE.—
Max. speed over 600 m.p.h. (960 km.h.).

THE BOEING STRATOCRUISER.

Stratocruisers are being operated by Pan American World Airways (28), Northwest Airlines (10), United Air Lines (6) and British Overseas Airways (10) in the following versions :—

Model 377-10-26 (P.A.W.A.). Seats for sixty-one day passengers on the main deck, with twenty-five seats available when eighteen berths are made up to sleep twenty-seven. Maximum seating accommodation (coach) 81-86.

Model 377-10-29 (P.A.W.A.). Seats for sixty on main deck, with twenty-five seats available when thirty berths are made up to sleep forty-five. Maximum seating accommodation (coach) 81-86. Acquired by Pan American World Airways with the purchase of American Overseas Airlines.

Model 377-10-30 (N.W.A.). Converted in 1953 to seat a total of 83 passengers.

Model 377-10-34 (U.A.L.). One complete luxury compartment aft and seats for fifty-six on main deck, with twenty-seats available when seventeen berths are made up to sleep twenty-six.

Model 377-10-28 (B.O.A.C.). Private stateroom aft, luxury compartment forward and seats for fifty-five on main deck, with twenty seats available when seventeen berths are made up to sleep twenty-six. This model was originally ordered by Scandinavian Airlines System (S.A.S.) but sold before completion to B.O.A.C. The original S.A.S. internal arrangements and furnishings were retained by B.O.A.C.

Model 377-10-32 (B.O.A.C.). Seats for twelve in the lounge on the lower deck and seats for sixty on main deck, with seats for twenty-eight when sixteen berths are made up to sleep twenty-four.

TYPE.—Four-engined Airliner.

WINGS.—Low-mid-wing cantilever monoplane. Boeing 117 aerofoil section. Aspect ratio 11.58. All-metal two-spar stressed-skin structure. Electrically-operated Fowler-type flaps. Built-in thermal anti-icing system. Gross wing area 1,769 sq. ft. (164.2 m.²).

FUSELAGE.—All-metal semi-monocoque structure of inverted figure-8 cross-section designed for pressurization. Max. width of fuselage 11 ft. (3.35 m.). Max. depth 15 ft. 2½ in. (4.65 m.). Ground clearance 1 ft. 10½ in. (0.55 m.).

TAIL UNIT.—Cantilever monoplane type. Fixed surfaces of two-spar stressed-skin construction with built-in thermal anti-icing system. Rear portion of fin and the rudder are hinged to fold sideways for hangar stowage or servicing, the overall height over fin being so reduced by 12 ft. (3.6 m.). Movable surfaces have metal frames and fabric covering and are aerodynamically and mass-balanced. Trim-tabs in elevators and rudder. Hydraulically-operated power-boost system for rudder control. Tailplane span 43 ft. (13.1 m.).

LANDING GEAR.—Retractable tricycle type. All three units with dual wheels, main wheels 4 ft. 8 in. (1.42 m.) diameter, nose-wheels 3 ft. (0.915 m.) diameter. Electric retraction with emergency manual operation. Pedal-operated service brakes and hand-operated emergency brakes operated by separate hydraulic systems. Wheel track 28 ft. 5.6 in. (8.62 m.). Wheel base 36 ft. 1.16 in. (11 m.). Min. turning radius (approx.) 29 ft. (8.85 m.). Fuselage static position 2° nose-up.

POWER PLANT.—Four Pratt & Whitney R-4360 Wasp-Major twenty-eight-cylinder four-row radial air-cooled geared and turbo-supercharged engines each developing a maximum output of 2,800 h.p. and with a take-off output of 3,500 h.p. with water-injection. Curtiss Electric or Hamilton Standard four-blade constant-speed full-feathering and braking airscrews 16 ft. 8 in. (5 m.) in diameter. All four engine nacelles quickly detachable and interchangeable. Five groups of seven nylon bladder-type fuel cells in wings, with total capacity of 7,790 U.S. gallons (29,450 litres).

ACCOMMODATION.—Two-deck fuselage, the upper deck accommodating the control cabin and the main passenger compartment and the lower deck a passenger lounge and two cargo holds. Control cabin in nose seats two pilots side-by-side with dual controls, navigator, engineer and radio operator. Various arrangements and furnishings of main upper deck passenger compartment permit seating for from 55 to 100 passengers. Standard arrangement accommodates a total of 81 passengers, 67 in main compartment and 14 in lower deck lounge. Circular stairway interconnects the two compartments. Main cabin entrance on port-side aft on upper deck level. Lower rear cargo door with built-in steps may be used to give access to main cabin *via* lounge stairway. In a sleeper version main cabin may be fitted with 28 upper and lower berths plus 5 seats, in addition to 14 seats in lounge. Fully equipped galley with electric ovens, refrigerators, cupboard space and vacuum containers for hot or cold foods and liquids. Men's and ladies' dressing rooms and toilets. Lower-deck fore and aft cargo compartment doors have sills at truck-level height. Capacity of compartments : control cabin 472 cub. ft. (13.2 m.³), main upper deck passenger compartment 4,041 cub. ft. (113.2 m.³), lower passenger lounge 500 cub. ft. (14.15 m.³), ladies' dressing room 228 cub. ft. (6.38 m.³), men's dressing room 238 cub. ft. (6.66 m.³), galley 350 cub. ft. (9.8 m.³), forward cargo hold 520 cub. ft. (14.56 m.³), rear cargo hold 325 cub. ft. (9.1 m.³). Heights of fuselage doors : main entrance door 9 ft. 10 in. (3 m.), forward cargo hold door 4 ft. 11 in. (1.5 m.), rear cargo hold door 4 ft. 5 in. (1.34 m.). Width of main cabin (inside linings) 10 ft.



The Boeing Stratocruiser Airliner (four 2,800 h.p. Pratt & Whitney Wasp Major engines).



A Boeing Stratocruiser (four 2,800 Pratt & Whitney R 4360 Wasp Major engines) in B.O.A.C. colours.

4½ in. (3.16 m.). Complete automatic air-conditioning equipment with pressurization permitting operation at 15,000 ft. (4,575 m.) with sea-level cabin atmosphere and at 25,000 ft. (7,625 m.) with equivalent cabin pressure of 5,500 ft. (1,680 m.), combined radiant and convection heating, cabin cooling and ground air-conditioning with self-contained power supply.

DIMENSIONS.—
Span 141 ft. 3 in. (43 m.).
Length 110 ft. 4 in. (33.65 m.).
Height 38 ft. 3 in. (11.66 m.).
Height (with fin and rudder folded) 26 ft. 7 in. (8.11 m.).

WEIGHTS AND LOADINGS.—
Weight empty 83,500 lb. (37,910 kg.).
Designed disposable load 59,000 lb. (26,786 kg.).
Designed normal take-off weight 145,800 lb. (76,195 kg.).
Landing weight 121,700 lb. (55,252 kg.).
Wing loading 80.5 lb./sq. ft. (392.8 kg./m.²).
Power loading 10.2 lb./h.p. (4.63 kg./h.p.).

PERFORMANCE.—
Max. speed 375 m.p.h. (603 km.h.) at 25,000 ft. (7,625 m.).
Max. cruising speed (1,900 h.p. per engine) 340 m.p.h. (544 km.h.) at 25,000 ft. (7,625 m.).
Landing speed 93 m.p.h. (150 km.h.).
Rate of climb at sea level 1,100 ft./min. (335 m./min.).
Rate of climb on three engines 500 ft./min. (152 m./min.).
Service ceiling over 32,000 ft. (9,760 m.).
Three-engine ceiling 21,000 ft. (8,540 m.).
Take-off run to clear 50 ft. (15.25 m.) (at 135,000 lb. = 61,290 kg. take-off weight) 1,800 yds. (1,647 m.).
Landing run from 50 ft. (15.25 m.) (at 105,000 lb. = 47,520 kg. landing weight) 1,880 yds. (1,720 m.).
Landing run from 50 ft. (15.25 m.) with reverse thrust on two engines 1,610 yds. (1,473 m.).
Range (max. fuel) 4,600 miles (7,360 km.).

THE BOEING STRATOFREIGHTER.
U.S. Air Force designation: C-97.

The C-97 Stratofreighter is the military transport counterpart of the Stratocruiser, from which it differs principally in the arrangement and equipment of the large two-deck fuselage. The XC-97 was, in fact, the forerunner of the civil Stratocruiser and all initial prototype trials of the civil airliner were conducted with the XC-97.

The principal structural modification to the C-97 fuselage involves the provision of large loading doors and an internally operated ramp under the rear fuselage to permit the loading of wheeled and tracked vehicles and other bulky cargo. An electrically-operated cargo hoist runs along the entire length of the fuselage. Three fully-loaded 1½-ton trucks or two light tanks can be driven into the fuselage, the drive-up ramp being raised and lowered by the cargo hoist. Adequate cargo handling and tie-down equipment is provided. The cabins can also be arranged to accommodate 134 fully-equipped troops, or be fitted out as a hospital transport for 83 stretcher cases and four attendants.

Three XC-97's were built and these were followed by ten YC-97's in three different versions of the basic design. These prototype and service test aircraft incorporated the wings, tail-unit, landing-gear and power-plant of the B-29. The C-97A and subsequent production versions use the main components of the B-50.

The principal features of the production versions of the C-97 are given below.

C-97A. Four Pratt & Whitney R-4360-27 engines. First production aircraft delivered to U.S.A.F. on October 15, 1949. C-97A has a normal payload of 41,400 lb. (18,800 kg.) and under special conditions can carry up to 53,000 lb. (24,060 kg.). It can accommodate 134 fully-equipped troops or mixed loads of cargo or troops. As an ambulance it can transport 83 stretcher patients with medical supplies and attendants.

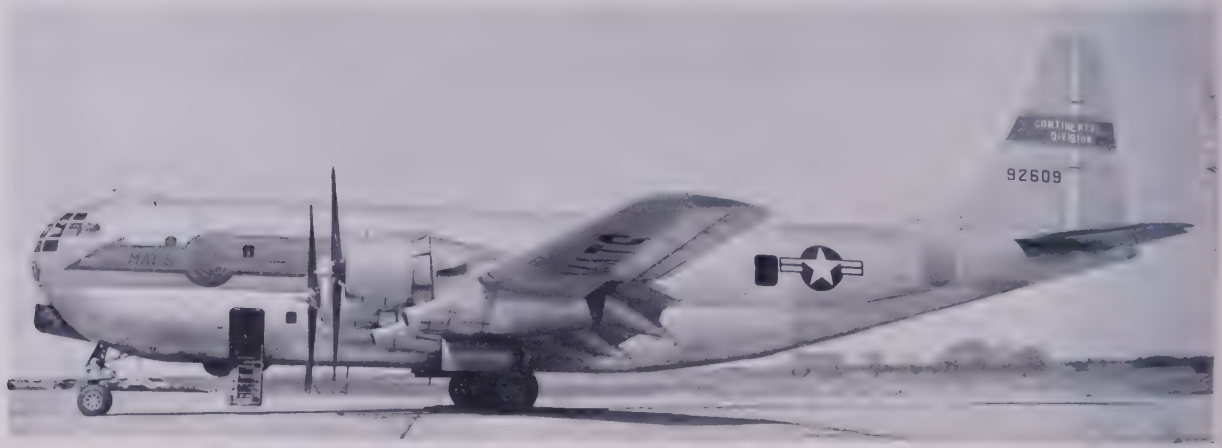
YC-97B. Four Pratt & Whitney R-4360-27 28-cylinder radial air-cooled engines. Personnel transport. Similar to civil Stratocruiser, complete with spiral stairs, lower deck lounge and rear upper deck galley. Accommodates 80 passengers, plus 17,000 lb. (7,720 kg.) of cargo. One aircraft only.

C-97C. Similar to C-97A in general details and performance. New radio antenna, heavier floor, higher payload. First production C-97C delivered to U.S.A.F. in February, 1951.

C-97D. Three specially-modified C-97A's supplied to U.S.A.F. Strategic Air Command as mobile "command posts." Used as Staff Transports and living quarters for key personnel in overseas training missions.

KC-97E. Four 3,500 h.p. Pratt & Whitney R-4360-59 engines. Multi-purpose transport and tanker. Has permanent fixtures for tanker but can be rapidly converted to cargo or troop carrier, or ambulance. "Pod" carrying "Flying Boom," operator and controls is detachable and tanks, pumps, etc. on upper deck are removable. First production KC-97E delivered to U.S.A.F. in July, 1951.

KC-97F. Four Pratt & Whitney R-4360-75 engines. Convertable tanker-transport. Other details and performance similar to KC-97E.



The Boeing C-97A Military Transport (four Pratt & Whitney R-4360-27 engines).



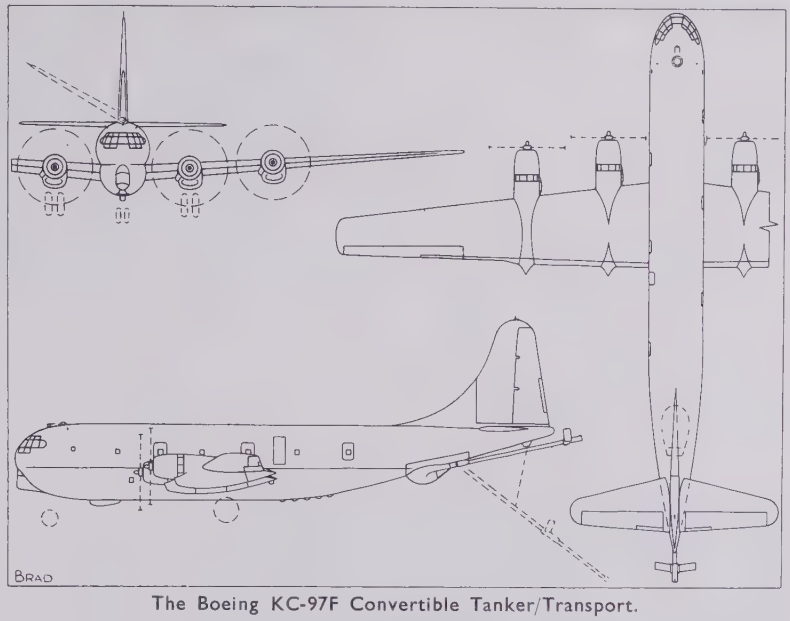
The Boeing KC-97F Convertible Tanker/Transport (four Pratt & Whitney R-4360 engines).

KC-97G. Development of KC-97F. Change in location of refueling tanks and related equipment, including boom, so that they need not be removed when aircraft is used as a transport. Provision for under-wing long-range tanks. Pressurisation system maintains ground atmospheric pressure to 15,000 ft. (4,575 m.).

DIMENSIONS.—
Span 141 ft. 3 in. (43.1 m.).
Length 110 ft. 4 in. (33.64 m.).
Height 38 ft. (11.6 m.).

WEIGHTS.—
Weight empty 82,500 lb. (37,450 kg.).
Weight loaded 142,500 lb. (64,700 kg.).
Landing weight 121,000 lb. (54,930 kg.).

PERFORMANCE.—
Max. speed 350 m.p.h. (560 km.h.).
Cruising speed 300 m.p.h. (480 km.h.).
Operating range 3,750 miles (6,000 km.).
Service ceiling 30,000 ft. (9,150 m.).



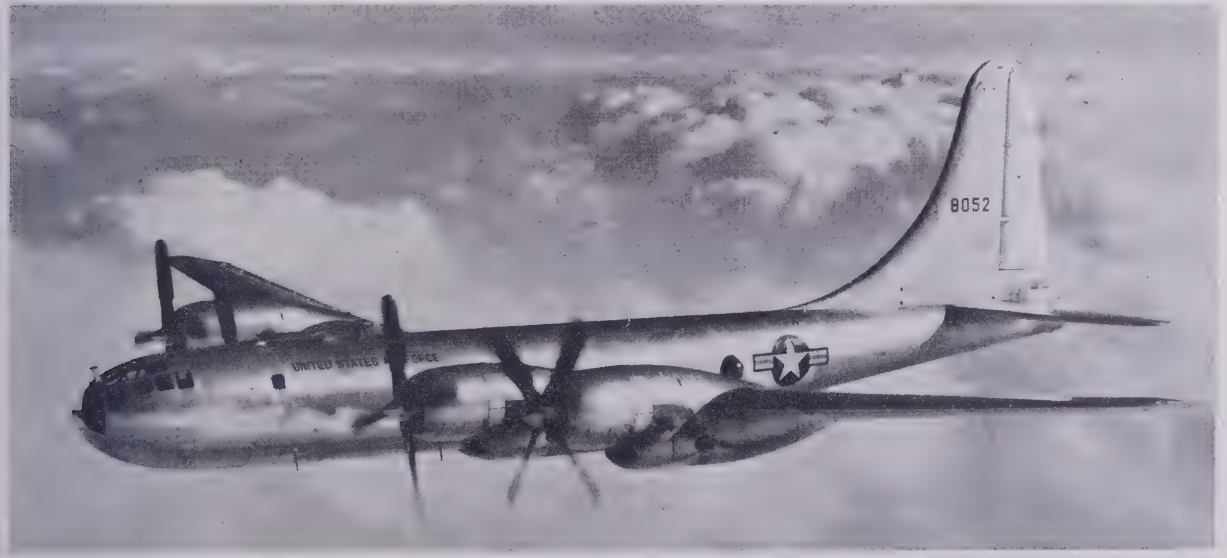
The Boeing KC-97F Convertible Tanker/Transport.

THE BOEING SUPERFORTRESS.
U.S. Air Force designation: B-50.

With the delivery to the U.S.A.F. on February 26, 1953, of the last Superfortress, a TB-50H, production of a famous family of Boeing four-engined propeller-driven bombers came to an end. The name Superfortress indentified both the B-29 and the B-50 and in ten years more than 4,250 Superfortresses were built, of which 3,970 were B-29's.

Until recently, the B-50 was the standard medium bomber in the Strategic Command, U.S.A.F. but it is now being replaced by the B-47. B-29's saw service in Japan and Korea. Both the B-29 and B-50 are still engaged on numerous second-line duties, including the Air Weather and Air Rescue Services of the Military Air Transport Service, and both are also used for training.

Full structural details of the B-29 and B-50 have appeared in previous editions



The Boeing TB-50D Crew Trainer (four Pratt & Whitney R-4360 engines).

of "All the World's Aircraft." Hereafter follow details of the various versions of the B-50, many of which are still in service.

B-50A. Four Pratt & Whitney R-4360 Wasp-Major engines with turbo-superchargers and driving four-blade constant-speed full-feathering and reversible airscrews. First production version. First B-50A flew for the first time on June 25, 1947.

TB-50A. Modified B-50A for bombing and navigation training. For details see under TB-50D.

B-50B. Certain structural changes increasing gross weight to 164,500 lb. (74,910 kg.), to permit greater load and range. Subsequently modified to RB-50B.

RB-50B. Photographic and weather reconnaissance conversion of B-50B. Retains bombing equipment but is fitted with four camera stations with a total of nine cameras, improved radar, flight refuelling equipment and weather recording instruments. May also carry two 700 U.S. gallon droppable wing-tip tanks. Photo-flash bombs for night photography carried in bomb-bay.

B-50D. Development of B-50B with increased bomb load or fuel capacity. Carries either two 700 U.S. gallon external fuel tanks or two 4,000 lb. (1,816 kg.) bombs under outer wings. Optically-flat bomb-aimer's panel in nose, changes in radar installation, etc. Equipped with Boeing "Flying-Boom" in-flight refuelling system.

TB-50D. Modified B-50D to train triple-duty crew members who will serve as combined bombardier-navigator-radar operators in Boeing B-47 jet bombers. All armament removed. Normal flight crew stations in forward fuselage, plus provisions for two student navigators and one instructor. Rear bomb-bay sealed and used for installation of a large part of the electronic equipment used in training. Rear crew compartment contains installations for one instructor and two student radar operators.

RB-50E. Photographic reconnaissance version of B-50D.

RB-50F. Same as RB-50E except for added Shoran radio.

RB-50G. Photographic reconnaissance version of B-50D.

TB-50H. Production version of TB-50D. First TB-50H flew for first time on April 29, 1952. First TB-50H delivered to U.S.A.F. on September 6, 1952, last on February 26, 1953.

CESSNA

CESSNA AIRCRAFT COMPANY, INC.

HEAD OFFICE AND WORKS: WICHITA, KANSAS.

Established: August 22, 1927.

President and General Manager: Dwane L. Wallace.

Vice-President and Chief Engineer: Tom Salter.

Secretary and Treasurer: Frank Boettger.

The Cessna Aircraft Company was founded by Mr. Clyde V. Cessna, a pioneer in U.S. aviation since 1911, and was incorporated in 1927. Before the war the company was in production with the Airmaster and the twin-engined T-50.

The Company has now designed five enclosed high-wing monoplanes for civilian use, the 85 h.p. and 90 h.p. Model 140, both two-seat aircraft; the 145 h.p. Model 170 and 225 h.p. Model 180 four-seaters, and the 240 h.p. Model 190 and 245 h.p. Model 195A, the last two being four/five-seat aircraft. Production of the Model 140 was discontinued in 1950, whereas the Model 180 was introduced in 1953.

In 1950 the Cessna 305, a military development of the Model 170, won the U.S.A.F. competition for a liaison and observation/reconnaissance aircraft to meet the requirements of the U.S. Army Field Forces, and the aircraft is still in production.

In 1953 Cessna announced the first flight of its new twin-engined Model 310. This aircraft, of which brief details are given below, will undergo service flight tests during the year and production will not begin until early 1954. The company was also successful in winning a U.S.A.F. design competition for a twin-jet primary trainer to be powered by two Continental-Turboméca Marboré turbojet engines.

In the personal aircraft field Cessna, in celebration of the 50th anniversary of flight, introduced a new 1953 "Golden Year" Model 170 and an entirely new aircraft, the "Golden Year" Model 180. These aircraft are described herewith.



An impression of the Cessna Model 318 Jet Trainer.

THE CESSNA MODEL 318.
U.S.A.F. designation: T-37.

Model 318 is the company's designation for the twin-jet primary trainer which was successful in winning a U.S.A.F. design competition early in 1953. The Model 318 will be an all-metal low-wing monoplane and will be powered with two Continental-Turboméca Marboré II turbojet engines. No further details were available at the time of writing.

DIMENSIONS.—
Span 33 ft. (10.06 m.).
Length 27 ft. 1 in. (8.26 m.).
Height 9 ft. 10 in. (3.00 m.).

WEIGHT (Designed).—
Loaded 5,600 lb. (2,542 kg.).

PERFORMANCE (Estimated).—
Max. speed 400 m.p.h. (640 km.h.).

THE CESSNA MODEL 310.

The Model 310 is a twin-engined five-seat cabin monoplane which marks Cessna's post-war re-entry into the light multi-engined personal or executive aircraft field. The prototype 310 made its first flight on January 3, 1953. It is being used, together with a second aircraft, for exhaustive service trials during 1953 and will probably go into production early in 1954.

The Model 310 is powered by two 225 h.p. Continental engines driving constant-speed full-feathering airscrews. All fuel is carried in permanently-attached wing-tip tanks so that the wing space normally used for fuel can accommodate the main landing-gear units. This in turn allows the use of smaller engine nacelles.

The cabin will seat pilot and four passengers, and there will be adequate luggage space, with external access, aft of the cabin.

DIMENSIONS.
Span (over wing-tip tanks) 36 ft. 1 in. (11.0 m.).
Length 27 ft. 1 in. (8.26 m.).
Height 10 ft. 2 in. (3.10 m.).

WEIGHTS AND PERFORMANCE.—
No data available.



The prototype Cessna Model 310 (two 225 h.p. Continental engines).

THE CESSNA MODEL 308.

The Model 308 is a four-seat military liaison, reconnaissance and ambulance monoplane which has been developed to meet the needs of the U.S. Armed Forces. It is of all-metal construction and is fitted with the characteristic Cessna wide-track spring-steel landing-gear, high-lift flaps, etc. It is powered by a 375 h.p. Lycoming flat-six engine which drives a Hamilton Standard airscrew.

No further details were available for publication at the time of writing.

THE CESSNA MODEL 305A BIRD DOG.
U.S.A.F. designation: L-19A.
U.S. Marine Corps designation: OE-1.

The Model 315 is a two-seat observation reconnaissance aircraft which is now in large-scale production for the U.S. Army Field Forces. It is a development of the Civil Model 170.

The cabin and rear fuselage has been completely redesigned. The rear fuselage has been cut down in height to give good rearward vision and roof is provided with transparent panels. A wide door opening and the ample rear cockpit and baggage compartment provide ample space for a standard stretcher, for which support brackets are installed.

The power-plant consists of a 213 h.p. Continental O-470-11 flat-six air-cooled engine. Fuel is carried in two wing tanks with a total capacity of 42 U.S. gallons (160 litres).

DIMENSIONS.—
Same as Model 170 except:
Height 7 ft. 6 in. (2.28 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,498 lb. (680 kg.).
Weight loaded (primary mission) 2,200 lb. (1,000 kg.).
Max. weight loaded (alternative missions) 2,430 lb. (1,103 kg.).
Wing loading 12.1 lb./sq. ft. (59 kg./m.²).
Power loading 11.05 lb./h.p. (5 kg./h.p.).

PERFORMANCE.—
Max. speed 130 m.p.h. (208 km.h.).
Cruising speed (29% power) at 5,000 ft. (1,525 m.) 104 m.p.h. (166.4 km.h.).
Stalling speed 54 m.p.h. (86.4 km.h.).
Initial rate of climb 1,485 ft./min. (453 m./min.).
Service ceiling 22,900 ft. (6,985 m.)
Absolute ceiling 24,800 ft. (7,565 m.).



The Cessna OE I Liaison Monoplane (213 h.p. Continental O 470 engine). (*Gordon Williams*)



The Cessna XL-19B (210 h.p. Boeing 502-8 turboprop engine).

Cruising range 800 miles (1,280 km.).
Take-off over 50 ft. (15.25 m.) obstacle from grass 560 ft. (171 m.).
Landing from 50 ft. (15.25 m.) on grass 600 ft. (183 m.).

THE CESSNA XL-19B.

One L-19, designated XL-19B, is powered with a 210 h.p. Boeing Model 502-8 turboprop engine. This is the result of a joint development programme of the U.S.A.F., the U.S. Army and the Cessna and Boeing companies to investigate the possibilities of the small gas-turbine engine for military uses. The advantages of the turbine over the conventional engine include a saving in power-plant weight, simplification of engine installation, elimination of cooling problems and almost complete suppression of vibration. The gas turbine can also operate on diesel fuel, any grade of automotive fuel, Army standard truck fuel, high octane gasoline or the standard turbo fuels. The XL-19B made its first flight on November 5, 1952.

THE CESSNA 1953 MODEL 170.

TYPE.—Four-seat Cabin monoplane.

WINGS.—High-wing braced monoplane. NACA 2412 wing section. Aspect ratio 7.46. Dihedral 2° 8′. All-metal single-spar structure with metal skin. Single bracing strut on each side. NACA slotted flaps inboard of ailerons. Aileron area (total) 18.3 sq. ft. (1.70 m.²). Total flap area 21.23 sq. ft. (1.97 m.²). Gross wing area 174 sq. ft. (16.2 m.²).

FUSELAGE.—All-metal monocoque.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Horn-balanced rudder and elevators. Areas: fin 9.0 sq. ft. (0.84 m.²), rudder 9.42 sq. ft. (0.87 m.²), elevators (total) 15.42 sq. ft. (1.43 m.²), tailplane 19.80 sq. ft. (1.84 m.²).

LANDING GEAR.—Cessna patented gear of chrome-vanadium spring steel. Hydraulic wheel-brakes. Wheel fairings optional. Steerable full swivelling tail-wheel. Track 7 ft. 6½ in. (2.29 m.). Edo Model 2000 floats, skis or cross-wing wheels are optional.

POWER PLANT.—One 145 h.p. Continental C145-2 six-cylinder horizontally-opposed air-cooled engine. McCauley two-blade metal airscrew. Fuel tanks in wings. Fuel capacity 42 U.S. gallons (159 litres).

ACCOMMODATION.—Cabin seats four in two pairs, front pair with dual controls. Baggage space aft of rear seats. 36-inch wide door on each side of cabin giving access to all seats and to simplify loading if rear seats removed and cabin used for freight. Combined heating and ventilation system. Fibreglas soundproofing.

DIMENSIONS.—
Span 36 ft. (10.9 m.).
Length 24 ft. 11½ in. (7.6 m.).
Height 6 ft. 7 in. (2 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,205 lb. (547 kg.).
Weight loaded 2,200 lb. (1,000 kg.).
Wing loading 12.6 lb./sq. ft. (61.48 kg./m.²).



The Cessna Model 170 (145 h.p. Continental C145 engine).

Power loading 15.2 lb./h.p. (6.9 kg./h.p.).

PERFORMANCE.—
Max. speed 140 m.p.h. (224 km.h.).
Cruising speed 120 m.p.h. (192 km.h.).
Stalling speed 52 m.p.h. (83 km.h.).
Initial rate of climb 690 ft./min. (210 m./min.).
Service ceiling 15,500 ft. (7,730 m.).
Endurance (cruising) over 4½ hours.

THE CESSNA MODEL 180.

The Model 180, although generally similar in layout and construction to the Model 170, is a completely new aircraft which was first announced in January, 1953.

A four-seater, the Model 180 is powered with a 225 h.p. Continental 470-A engine driving a Hartzell metal constant-speed airscrew.

The most noticeable external difference between the Models 170 and 180 is the latter's new tail-unit of distinctive outline, which can be seen in the accompanying illustration.

DIMENSIONS.—
Span 36 ft. (10.9 m.).
Length 26 ft. 2 in. (7.9 m.).
Height 7 ft. 6 in. (2.28 m.).



The Cessna Model 180 (225 h.p. Continental 470-A engine).

WEIGHTS AND LOADINGS.
Weight empty 1,460 lb. (663 kg.).
Weight loaded 2,550 lb. (1,158 kg.).
Wing loading 14.6 lb./sq. ft. (71.25 kg./m.²).
Power loading 11.3 lb./h.p. (5.13 kg./h.p.).
PERFORMANCE.
Max. speed over 165 m.p.h. (264 km.h.).
Cruising speed over 150 m.p.h. (240 km.h.).
Initial rate of climb 1,150 ft./min. (350 m./min.).
Service ceiling 19,800 ft. (6,040 m.).
Endurance (cruising) over 4½ hours.

THE CESSNA MODEL 190.

TYPE.—Four/five-seat Cabin monoplane.
WINGS.—High-wing cantilever monoplane. NACA 2412 wing section. Aspect ratio 5.94. Two-spar all-metal structure tapering in chord and thickness from root to tip. All-metal ailerons. Electrically-operated split flaps inboard of ailerons. Total area of ailerons 12.32 sq. ft. (1.14 m.²). Total flap area 8.68 sq. ft. (0.79 m.²). Gross wing area 218.125 sq. ft. (20.2 m.²).
FUSELAGE.—Oval section all-metal monocoque structure.
TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering. Areas: fin 8.78 sq. ft. (0.81 m.²), rudder 7.77 sq. ft. (0.72 m.²), elevators (total) 15.41 sq. ft. (1.43 m.²), tailplane 19.80 sq. ft. (1.84 m.²).
LANDING GEAR.—Cessna patented gear of chrome-vanadium spring steel, the flexing of the two aerodynamically-clean legs providing the only means of shock-absorption. Wheel brakes. Steerable tail-wheel. Track 7 ft. 11 in. (2.41 m.).
POWER PLANT.—One 240 h.p. Continental R-670-23 nine-cylinder radial air-cooled engine driving a Hamilton Standard Hydromatic constant-speed airscrew. Fuel tanks in wings. Total fuel capacity 80 U.S. gallons (302 litres).
ACCOMMODATION.—Enclosed cabin seating four or five, two forward with throw-over control column, and two or three on seat across the back of the cabin. Luggage compartment aft of rear seat accessible from cabin or from outside through door on starboard side. Sound-proofing and cabin heating and ventilation. Two-way radio with loud speaker. Retractable steps to entrance doors on each side of cabin. Rear seat may be removed by undoing four bolts to provide 85 cub. ft. of cargo space.
DIMENSIONS.
Span 36 ft. 2 in. (11 m.).
Length 27 ft. 4 in. (8.33 m.).
Height 7 ft. 2 in. (2.16 m.).
WEIGHTS AND LOADINGS.—
Weight empty 2,015 lb. (915 kg.).
Weight loaded 3,350 lb. (1,521 kg.).
Wing loading 15.36 lb./sq. ft. (74.85 kg./m.²).
Power loading 13.96 lb./h.p. (6.3 kg./h.p.).
PERFORMANCE.—
Max. speed 176 m.p.h. (282 km.h.).
Cruising speed (70% power) 160 m.p.h. (256 km.h.) at 7,000 ft. (2,135 m.).
Stalling speed 62.5 m.p.h. (100 km.h.).
Initial rate of climb 1,050 ft./min. (477 m./min.).
Service ceiling 16,000 ft. (4,880 m.).
Range over 750 miles (1,200 km.).



The Cessna Model 195 (300 h.p. Jacobs R-755 engine).

THE CESSNA MODEL 195.

U.S.A.F. designation: LC-126A.

The Model 195 is similar to the Model 190 except that it is fitted with a 300 h.p. Jacobs R-755-A2 engine in place of the 240 h.p. Continental engine. This model may be fitted with Edo 3430 floats.

The U.S.A.F. has acquired a number of Model 195's under the designation LC-126A. These aircraft have been specially modified for Arctic rescue work and are equipped with interchangeable wheel, float and ski landing-gear.

DIMENSIONS.—
Same as for Model 190 except Length 27 ft. 4 in. (8.33 m.).
WEIGHTS AND LOADINGS.—
Weight empty 2,030 lb. (922 kg.).
Weight loaded 3,350 lb. (1,521 kg.).
Wing loading 15.36 lb. sq./ft. (14.85 kg./m²).
Power loading 11.16 lb./h.p. (5.06 kg./h.p.).
PERFORMANCE.—
Max. speed 180 m.p.h. (288 km.h.).
Cruising speed (70% power) 165 m.p.h. (264 km.h.) at 7,000 ft. (2,135 m.).
Stalling speed 62.5 m.p.h. (100 km.h.).
Initial rate of climb 1,210 ft./min. (370 m./min.).
Service ceiling 18,300 ft. (5,580 m.).
Range over 750 miles (1,200 km.).

THE CESSNA MODEL 195A.

The Model 195A is identical to the Model 190 except that it is powered with a 245 h.p. Jacobs R-744-A2 engine.

WEIGHTS.—
Weight empty 2,065 lb. (937 kg.).
Weight loaded 3,350 lb. (1,521 kg.).
PERFORMANCE.—
Max. speed 173 m.p.h. (277 km.h.).
Cruising speed (70% power) 155 m.p.h. (248 km.h.).
Stalling speed 62.5 m.p.h. (100 km.h.).
Initial rate of climb 940 ft./min. (287 m./min.).
Service ceiling 13,800 ft. (4,210 m.).
Absolute ceiling 15,500 ft. (4,730 m.).



The Cessna LC-126A (300 h.p. Jacobs engine).

CHANCE VOUGHT

CHANCE VOUGHT AIRCRAFT DIVISION, UNITED AIRCRAFT CORPORATION.

HEADQUARTERS: DALLAS, TEXAS.
General Manager: F. O. Detweiler.
Executive Assistant to the General Manager: H. B. Sallada.
Administrative Assistant to the General Manager: J. J. Gafiney.
Assistants to the General Manager: J. J. Hospers, J. D. P. Hodapp and G. K. Johnson.
Divisional Controller: N. V. Turney.
Chief Engineer: Fred N. Dickerman.
Factory Manager: B. D. Taliaferro.

Chance Vought's current production aircraft is the F7U-3 Cutlass, a swept-wing, tail-less fighter developed for the U.S. Navy for shipboard operations. The first production model of the F7U-3 was flown for the first time on December 20, 1951, and has been in production since that time.

The classified nature of Chance Vought's guided missile programme permits only the briefest reference to the Regulus, a naval assault missile intended for launching four submarines, surface vessels and shore bases. Development of the Regulus, under the sponsorship of the U.S. Navy Bureau of Aeronautics, began in 1947. The missile resembles a small swept-wing jet fighter aircraft and is about 30 ft. (9.15 m.) long. Equipped with specially-developed remote control devices and a temporary landing-gear, it was possible to make as many as ten flights with a single test vehicle during the test development and training trials.



The Chance Vought F7U-3 Cutlass Single seat Fighter (two Westinghouse J40 turbojet engines).



The Chance Vought F7U-3 Cutlass Single-seat Fighter (two Westinghouse J40 turbojet engines).

This has permitted both the gathering of maximum test information and reduced development costs. Exhaustive flight testing under a broad diversity of conditions has been conducted with uniformly excellent results.

The tactical Regulus missile has no landing-gear but carries a powerful warhead. The rate of production of the Regulus will be considerably accelerated during 1953.

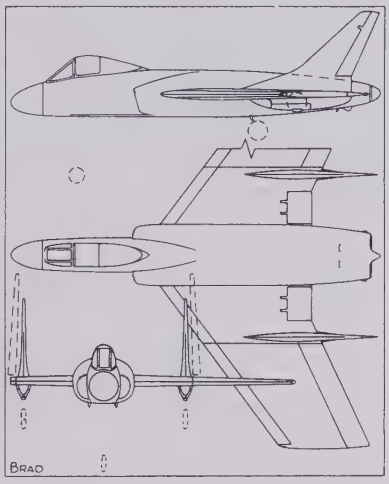
The Chance Vought F4U Corsair, the last propeller-driven fighter to be manufactured in the United States, went out of production when the 12,571st and last Corsair, an F4U-7 built for the French Navy under the Mutual Defense Assistance Programme, left the production line, at Dallas on Christmas Eve, 1952. Another version, the AU-1, which was evolved especially to meet the needs of the Korean campaign, went out of production in October, 1952, when the last four were delivered to the Navy.

The prototype XF4U-1 first flew in 1940 and the first production F4U-1 on June 25, 1942. Although there were other fighter aircraft which were built in greater numbers, the Corsair holds the record for being in continuous production for the longest period of time. A full description of the Corsair in its many successive forms will be found in previous editions of "All the World's Aircraft."

THE CHANCE VOUGHT CUTLASS.

U.S. Navy designations : F7U and A2U.

The Cutlass is a swept-wing tail-less single-seat twin-jet aircraft which is in production for the U.S. Navy as an interceptor fighter (F7U-3) and as a ground support fighter (A2U-1). The wing, of symmetrical section, is fitted with full-span leading-edge slats, air brakes, power-operated irreversible "ailavators," or combined ailerons and elevators, and vertical fin and rudder surfaces.



The Chance Vought F7U-3 Cutlass.

Two Westinghouse turbojets provide the power-plant. The Cutlass was the first fighter in the United States to be designed from the start for the use of afterburners.

The three following versions of the Cutlass have been announced :—

F7U-1. Two Westinghouse J34-WE-32 turbojets with afterburners. First prototype XF7U-1 flew on September 29, 1948. First production F7U-1 flew on March 1, 1950. Fourteen built. Used for training and operational evaluation for aircraft-carrier use.

F7U-3. Two Westinghouse J40 turbojet engines. Larger and more heavily-armed than the F7U-1. Fitted with dual hydraulic power control system in place of the single power system and separate emergency manual system used in the F7U-1. The two sets of speed brakes of the F7U-1 replaced by a single set in F7U-3. Considerable changes have been made to simplify maintenance, Engine servicing procedure calls for aft removal rather than through engine access doors in under-side of fuselage. More than 100 access doors and panels have been added to render all controls, instrumentation, electronics and gun sections easily accessible. Because of the greater weight of the F7U-3 a heavier nose landing-gear with dual wheels is fitted. The arrester hook installation has been simplified. The first production F7U-3 powered temporarily by two Allison J35 engines flew for the first time on December 20, 1951.

A2U-1. Ground support version of F7U-3. Heavily armoured fuselage and automatically-fired rocket and bomb armament.

All other information about the Cutlass is restricted.

CHASE

CHASE AIRCRAFT COMPANY, INC.

Head Office and Works : Mercer County Airport, Trenton, N.J.

President : Clay P. Bedford.

Vice-President and General Manager : H. E. Ryker.

Treasurer and Comptroller : J. X. Cousins.

Secretary and Executive Engineer : W. F. Sauers.

Assistant Chief Engineer : M. Gregor.

The Chase Aircraft Company was formed in 1943 to undertake the design, development and production of assault cargo gliders for the Air Forces. In five years the company built three such aircraft.

Late in 1946 the company converted to all-metal design and in a little more than a year the 32-seat CG-18A all-metal cargo and troop transport glider was designed, built and flown.

So well did the CG-18 perform that it led to the consideration of the construction of powered troop-carrying aircraft based on the same basic wing and fuselage design.

Out of this consideration came the design for the C-122, a twin-engined troop and cargo-carrying transport which likewise was capable of carrying 30 fully-equipped troops. The prototype C-122 was flown for the first time on November 18, 1948. A small quantity was produced for the U.S.A.F. The C-122 has been illustrated and described in previous editions of this Annual.

While the C-122 was still under construction Chase undertook the building of a new and still larger troop and cargo transport for the U.S.A.F. Two prototypes were built, one as a pure glider and the other, the XC-123, as a powered aircraft. The latter was flown for the first time on October 14, 1949.

THE CHASE MS-8 AVITRUC.

U.S. Air Force designation: C-123B.

The MS-8 has the distinction of having flown in three distinct forms—as a glider, as a piston-engine-powered transport and with jet-power.

Originally two prototypes were built, a glider (XCG-20) and a piston-engined aircraft (XC-123).

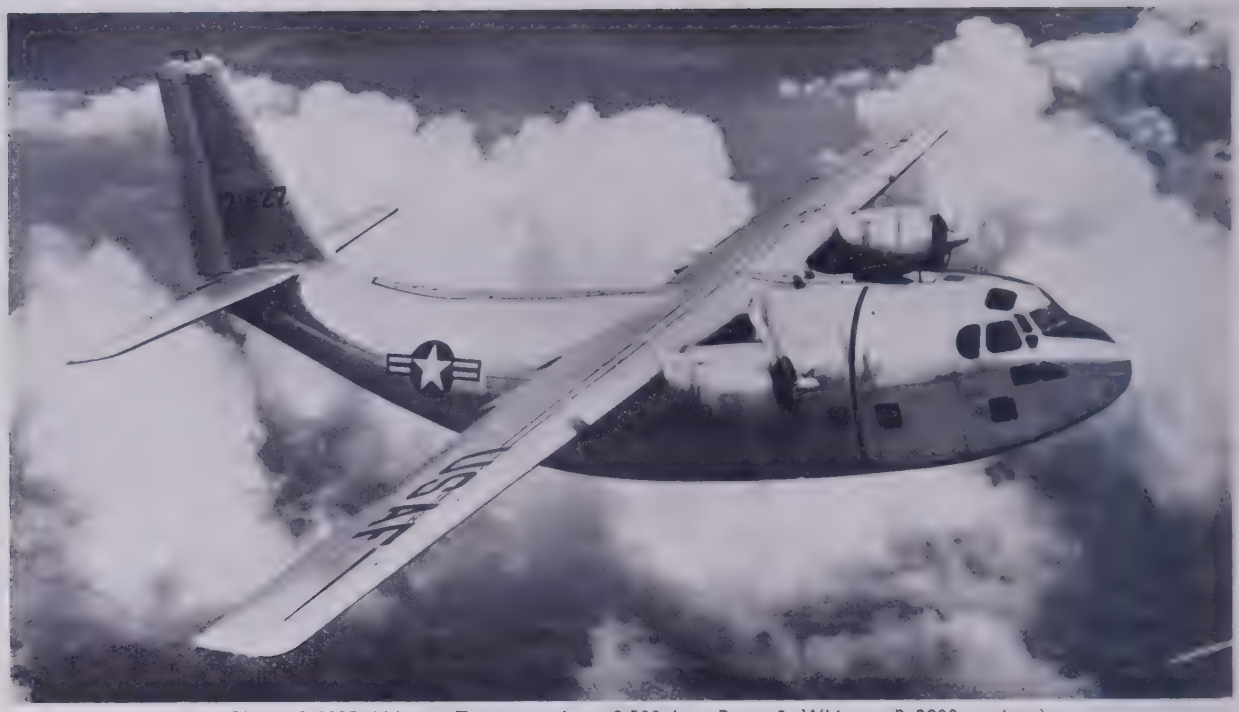
Subsequently the glider was fitted with four General Electric J47 turbojet engines (5,200 lb. = 2,360 kg. s.t. each), the engines being installed in pairs in pods similar to those fitted in the outboard positions in the Convair B-36D. This jet-powered model, designated the XC-123A, made its first flight on April 21, 1951.

The description which follows refers specifically to the C-123B transport-powered with two Pratt & Whitney R-2800 engines.

A production order for 300 C-123B's held by the Kaiser-Frazer Corpn., which owned a 51 per cent. interest in the Chase company, was cancelled in June, 1953, and new bids are being asked for.

In the meantime, Kaiser has acquired the remaining 49 per cent. interest in Chase, which will become a subsidiary of the Willys Motor Company, also owned by Kaiser-Frazer.

Type.—Twin-engined Troop and Cargo-carrying Transport for operation from short or unprepared landing fields.



The Chase C-123B Military Transport (two 2,300 h.p. Pratt & Whitney R-2800 engines).

WINGS.—High-wing cantilever monoplane. Aspect ratio 9.89. All metal structure. Flaps inboard of ailerons and divided by tail cones of engine nacelles. Aileron area 83.28 sq. ft. (7.73 m.²), flap area 128.00 sq. ft. (11.89 m.²), gross wing area 1,223.22 sq. ft. (113.64 m.²).

FUSELAGE. The main fuselage frame is of stressed-skin monocoque construction. The nose is of truss-type welded steel tubing to provide maximum crash protection for flight personnel.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with fabric-covered control surfaces. Trim-tabs in elevators and rudder. Total horizontal tail area 337.4 sq. ft. (31.34 m.²), fin area 127.49 sq. ft. (11.84 m.²), elevator area 119.77 sq. ft. (11.13 m.²), rudder area 55.21 sq. ft. (5.13 m.²).

LANDING GEAR.—Retractable tricycle type. Main gear retracts up into fuselage and is completely enclosed when retracted. A high-strength drag link is incorporated to carry drag loads and side loads from the gear to increase the utility of the aircraft for rough field operation. The dual wheel nose wheel unit is also completely retractable. Main wheels have low-pressure tyres and Westinghouse Decelostat anti-skid braking equipment. Track 12 ft. 1 in. (3.69 m.).

POWER PLANT.—Two 2,300 h.p. Pratt & Whitney R-2800-99W radial air-cooled engines driving Hamilton Standard three-blade steel constant-speed feathering and reversing airscrews. Jettisonable self-sealing fuel tanks installed in nacelles. The power-plant installation is such that a complete engine change forward of the fire-wall, may be made in 45 minutes. Quick disconnect fittings are provided in all lines and mechanisms to facilitate the operation.

ACCOMMODATION.—Flight compartment in nose, seats crew of two. Cargo compartment 36 ft. 8 in. (11.18 m.) long, 9 ft. 2 in. (2.79 m.) wide and 8 ft. 2 in. (2.48 m.) high with a usable floor area of 450 sq. ft. (41.8 m.²) and cubic capacity of 3,570 cub. ft. (100 m.³). The compartment floor is stressed to support distributed loads of 250 lb./sq. ft. (1,220 kg./m.²) and two tread-ways accommodate vehicles with loadings up to 7,500 lb. (3,405 kg.) per wheel. Tie-down fittings are spaced over a total floor area on a 20 in. (50.8 cm.) grid pattern, each fitting capable of sustaining a 10,000 lb. (4,535 kg.) load in any direction. The large rear loading door is formed by lowering the rear sloping wall of the hold to form a ramp and an upper door which folds inside fuselage to give adequate clearance for vehicles, bulky freight, etc. Ramp is hydraulically operated. Compartment can receive a 155 mm. howitzer and one truck or any comparable combination of wheeled units. As a personnel carrier, plane can accommodate 61 fully-equipped troops, 50 stretcher patients, plus 6 sitting patients and 6 medical attendants. Personnel can enter by side doors which may also be used for parachute jumping.

DIMENSIONS.—
Span 110 ft. (33.55 m.).
Length 75 ft. 9 in. (23.10 m.).
Height 34 ft. 1 in. (10.38 m.).

WEIGHTS AND LOADINGS.—
Weight empty 29,906 lb. (13,577 kg.).
Max. gross weight 71,000 lb. (32,235 kg.).
Wing loading 43.5 lb./sq. ft. (212.28 kg./m.²).
Power loading 11.4 lb./h.p. (5.17 kg./h.p.).

PERFORMANCE.—
Max. speed 245 m.p.h. (392 km.h.).
Cruising speed 205 m.p.h. (328 km.h.).
Stalling speed 75 m.p.h. (120 km.h.).
Rate of climb 1,150 ft./min. (350 m./min.).
Service ceiling 29,000 ft. (8,845 m.).
Range with max. cargo and optimum cruising speed at 5,000 ft. (1,525 m.) 1,470 miles (2,350 km.).

COLONIAL

COLONIAL AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: 23, EAST ROGUE'S PATH, HUNTINGTON STATION, NEW YORK.

President: David B. Thurston.

The Colonial Aircraft Corpn. was formed in 1946 by Mr. D. B. Thurston and a group of four other designers and builders to build the Skimmer single-engined pusher amphibian flying-boat. The prototype Skimmer was first flown on July 17, 1948. A flying programme was being conducted in 1953 with a view to obtaining final C.A.A. certification before the end of the year.

THE COLONIAL MODEL C-1 SKIMMER.

TYPE.—Single-engined 2/3-seat Amphibian.

WINGS.—Cantilever shoulder-wing monoplane with tapered wing sections attached directly to sides of hull. Structure consists of duralumin leading and trailing-edge torque boxes separated by a single duralumin main spar or beam. All-metal ailerons. Hydraulically-operated slotted flaps over 80 per cent. of span. Gross wing area 150.6 sq. ft. (14 m.²).

HULL.—Single-step all-metal structure.

TAIL UNIT. Cantilever monoplane type. All-metal construction. Controllable elevator trim-tabs. Span of tail 10 ft. (3.05 m.), vertical tail area 19.42 sq. ft. (1.8 m.²), horizontal tail area 26.39 sq. ft. (2.45 m.²).

LANDING GEAR.—Retractable tricycle type. Knee-action oleo struts on main gear, which retracts into wings. Long-stroke nose-wheel oleo. Nose wheel protrudes when retracted to serve as bumper. Hydraulic retraction by Adel electric-hydraulic power package. Goodyear wheels, tyres and single-disc hydraulic brakes. Nose wheel is free to swivel 30° either way.

POWER PLANT.—One 125 h.p. Lycoming O-290-D four-cylinder horizontally-opposed air-cooled engine mounted on pylon above hull and driving an Aeromatic propeller 6 ft. 1 in. (1.8 m.) diameter. Fuel capacity 40 U.S. gallons (151 litres).

ACCOMMODATION.—Enclosed cabin normally seating two side-by-side, but third person may be seated behind. Throw-over wheel control standard but dual controls available.



The Colonial C-1 Skimmer Light Amphibian (125 h.p. Lycoming engine). *(Levy-Diegen).*

Blind-flying instruments, two-way radio and landing lights standard equipment.
Baggage capacity of over 40 cub. ft. (1-13 m.³) available in passenger compartment.

DIMENSIONS.—
Span 34 ft. (10.37 m.).
Length 23 ft. 6 in. (7.16 m.).
Height overall 8 ft. 10 in. (2.68 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,300 lb. (590 kg.).
Disposable load 650 lb. (295 kg.).
Weight loaded 1,950 lb. (885 kg.).
Wing loading 12.9 lb./sq. ft. (62.95 kg./m.²).
Power loading 15.6 lb./h.p. (6.08 kg./h.p.).

PERFORMANCE.—
Max. speed 125 m.p.h. (200 km.h.).
Cruising speed 115 m.p.h. (184 km.h.).
Stalling speed 46 m.p.h. (73.6 km.h.).
Initial rate of climb 700 ft./min. (213 m./min.).
Cruising range 700 miles (1,120 km.).

CONVAIR



The Convair XF2Y-1 Sea Dart Delta-wing Fighter Seaplane taxying out of the water under its own power.

THE CONSOLIDATED VULTEE AIRCRAFT CORPORATION.

HEAD OFFICE: SAN DIEGO 12, CAL.

MANUFACTURING DIVISIONS: SAN DIEGO AND POMONA, CAL. AND FORT WORTH, TEX.

Chairman of the Board: John Jay Hopkins.
Vice-Chairman: LaMotte T. Cohu.
President: Joseph T. McNarney.
Executive Assistant to President: E. P. Wohl.
Vice-President and Assistant to President: T. G. Lanphier.
Executive Vice-President: J. V. Naish.
Vice-President: R. H. Biron, Jr.
Vice-President—Finance: L.W. Miller.
Vice-President—Engineering: R. C. Sebold.
Vice-President and General Counsel: R. B. Watts.
Manager, San Diego Division: Bernard F. Coggan.
Manager, Pomona Division: Gage Irving.
Manager, Daingerfield Division: J. E. Arnold.
Manager, Fort Worth Division: A. C. Esenwein.
Controller: D. T. Fisher.
Secretary: Edmund Burke.
Treasurer: G. T. Bovee.

Consolidated Vultee Aircraft Corporation resulted from the merger on March 17, 1943, of the properties of the Consolidated Aircraft Corporation and Vultee Aircraft, Inc. The Consolidated Aircraft Corporation was incorporated by Major Reuben H. Fleet and a group of associates on May 29, 1923.

After having outgrown its original Rhode Island facilities, Consolidated moved in 1924 to Buffalo, N.Y., where it leased a portion of the old wartime Curtiss plant. In the Autumn of 1935 Consolidated moved from Buffalo to San Diego, Cal. to take advantage of an ice-free harbour and all-the-year-round good flying weather.

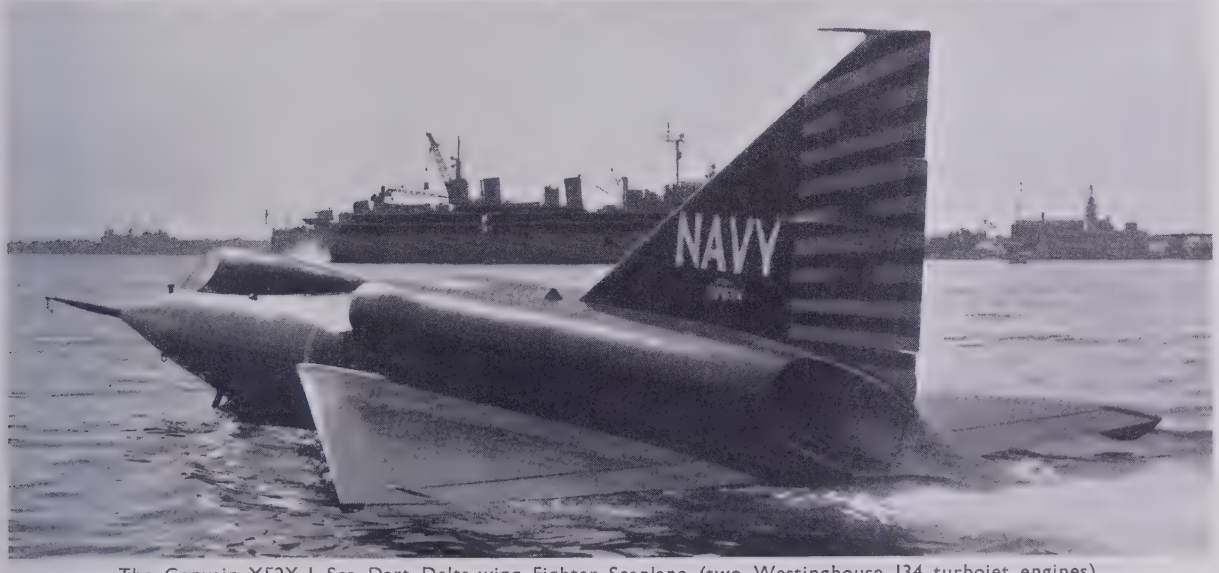
Before the merger with Vultee in 1943, Consolidated acquired the Thomas-Morse Aircraft Corporation of Ithaca, N.Y. In 1940 Consolidated purchased the Hall Aluminium Aircraft Corporation.

The present activities of the manufacturing divisions may be summarised as follows:—San Diego Division: production of the Convair-Liner 340 and military counterparts of the Convair-Liner 240 and 340—the T-29 navigator-bombardier trainer and the C-131 air evacuation transport; the R3Y-1 cargo transport version of the XP5Y-1 flying-boat; the F-102 delta-wing supersonic interceptor fighter; development of the XF2Y-1 Sea Dart experimental delta-wing fighter-type seaplane; and research and development in pilotless aircraft, guided missiles and other restricted projects; Pomona Division:—research, development and production of guided missiles for the U.S. Navy Bureau of Aeronautics; Fort Worth Division:—production of the B-36 and research and development work on restricted projects.

The Daingerfield Division at Daingerfield, Texas, operates for the U.S. Navy Bureau of Ordnance a highly-important but little publicised Ordnance Aerophysics Laboratory which includes a supersonic wind-tunnel and a ramjet burner test centre for the development of guided missiles.

THE CONVAIR XF2Y-1 SEA DART.

The XF2Y-1 is an experimental twin-jet delta-wing fighter type seaplane which has been developed and built for the U.S. Navy Bureau of Aeronautics. It is the first combat-type aircraft to be equipped with retractable hydro-skis. The first prototype XF2Y-1 Sea Dart,



The Convair XF2Y-1 Sea Dart Delta-wing Fighter Seaplane (two Westinghouse J34 turbojet engines).

which is powered with two Westinghouse J34 turbojet engines, was launched on San Diego Bay on December 16, 1952, for extensive taxying and other water trials. It made its first flight on April 9, 1953.

Convair is under contract to build two prototype Sea Darts and eleven service test aircraft, the latter to be fitted with engines of greater power.

DIMENSIONS.—
Span 30 ft. 6 in. (9.3 m.).
Length 41 ft. 2 in. (12.5 m.).
Height (on hydro-skis) 21 ft. 1 in. (6.4 m.).

THE CONVAIR XF-102.

Early in 1952 the U.S.A.F. announced that Convair had been awarded a contract for the construction of two prototypes of a very high-speed jet interceptor. The contract includes tooling for volume production.

Later information has disclosed that the XF-102 is a supersonic delta-wing fighter which will be powered by two Pratt & Whitney J57 turbojet engines. It will be fitted with an automatic electronic control system which will only need to be monitored by the pilot. The craft is also expected to carry a guided missile which will also be automatically fired. The automatic pilotage and firing systems have been developed by the Hughes Aircraft Company.

DIMENSIONS (approx.).—
Span 60 ft. (18.3 m.).
Length 75 ft. (22.8 m.).
Height 40 ft. (12.2 m.).

THE CONVAIR MODEL 7002.
U.S.A.F. designation: XF-92A.

The Model 7002 Research aircraft was originally built as a flying mock-up to test the delta wing configuration as a phase in the development of the XF-92 jet and rocket powered fighter monoplane. The original contract for the XF-92 was cancelled, but since then the Model 7002 has been given the designation XF-92A.

The delta wing has a 60° sweepback on its leading-edge and carries "elevons" on its straight trailing-edge. The large vertical fin and rudder give directional control and stability.

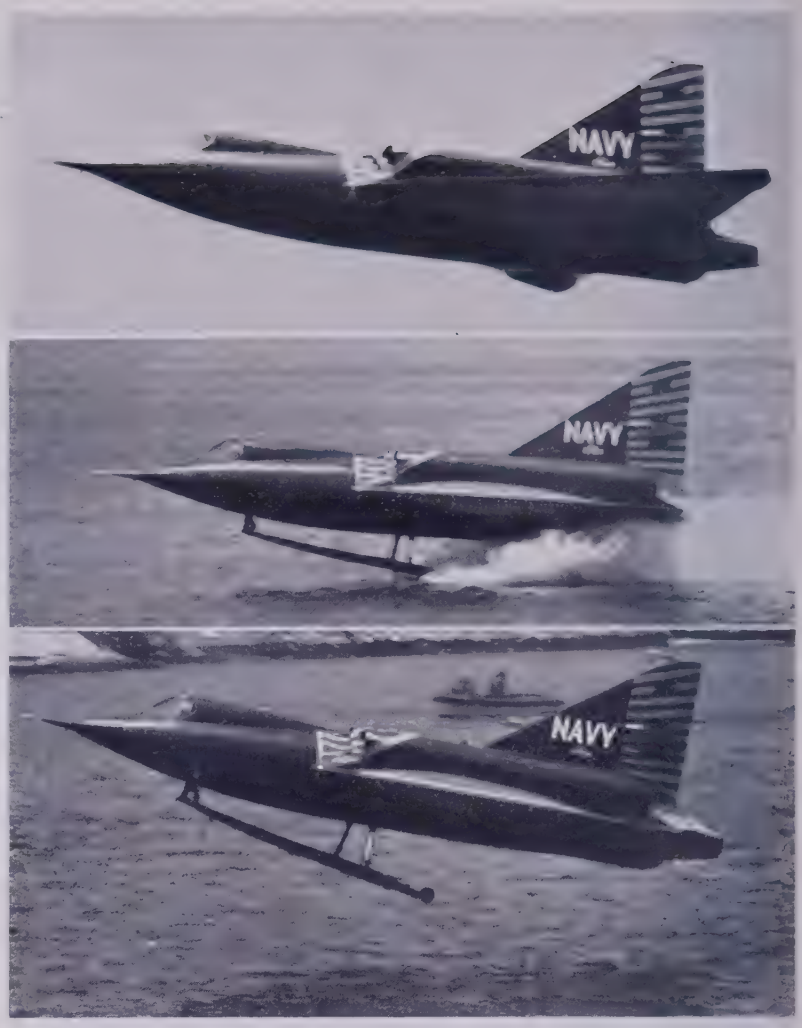
The power-plant now consists of an Allison J33-A-29 turbojet engine with afterburner.

The XF-92A has completed its Air Force evaluation programme and was handed over to the NACA for further research in 1952.

DIMENSIONS (Approx.).—
Span 31 ft. 3 in. (9.53 m.).
Length 42 ft. 5 in. (12.93 m.).
Height 17 ft. 8 in. (5.38 m.).

DESIGNED LOADED WEIGHT (Approx.).—
15,000 lb. (6,810 kg.).

PERFORMANCE.—
No data available.



The Convair XF2Y-1 Sea Dart (top) in flight with its hydro skis retracted ; (middle) taxying at speed for take off ; and (bottom) just about to touch down.

THE CONVAIR XP5Y-1.

The XP5Y-1 is an experimental high-performance long-range Patrol flying-boat, two prototypes of which were ordered by the U.S. Navy. The XP5Y-1 has a hull of high length/beam ratio, a cantilever high-wing and single fin tail-unit. The power-unit consists of four 5,500 h.p. Allison T40 airscrew gas-turbines, each engine consisting of two T38 units paired and driving contra-rotating airscrews through a common gear-box.

The first XP5Y-1 was completed in 1949, and it made its first flight on April 18, 1950.

This aircraft was destroyed in 1953 following the failure of the tail trim control. The second prototype XP5Y-1 had not been completed at the time of writing owing to delays in the delivery of the engines.



The Convair XF-92A Delta-wing Research Monoplane (Allison J33 turbojet engine with afterburner).



The first prototype Convair YB-60 Heavy Bomber (eight Pratt & Whitney J57 turbojet engines).

THE CONVAIR R3Y-1 TRADEWIND.

The R3Y-1, for which an initial production order is held by Convair, is a long-range transport version of the previously-described XP5Y-1, from which it differs only in function and equipment.

The R3Y-1 has pressurised, air-conditioned and sound-proofed accommodation and may carry personnel or cargo, or may be fitted as an ambulance for the transport of both sitting and stretcher cases. All personnel seats are of the backward-facing type. A large cargo-loading door is located on the port side aft and there are personnel loading doors on both sides of the hull.

The first production R3Y-1 was scheduled to be launched in the late Summer of 1953.

DIMENSIONS.—
Span 145 ft. (44.2 m.).
Length 142 ft. 6 in. (43.5 m.).
Height (on beaching cradle) 51 ft. 5 in. (15.7 m.).

WEIGHTS.—
Loaded over 160,000 lb. (72,640 kg.).

PERFORMANCE.—
Max. speed over 350 m.p.h. (560 km.h.) at 25,000 ft. (7,620 m.).
Cruising speed about 300 m.p.h. (480 km.h.).
Rate of climb at S.L. 2,500 ft. min. (760 m./min.).
Max. Range 4,000 miles (6,400 km.).

THE CONVAIR YB-60.

The YB-60 is an advanced turbojet-powered development of the B-36 with swept-back wings, the contract for which was awarded to Convair on March 15, 1951. The first of two prototypes was ready for its engines eight months later and this aircraft made its maiden flight on April 18, 1952.

The YB-60 uses the same fuselage as the B-36 except for modification to the nose, and basically the same centre-section and landing-gear. The new swept wings reduce the overall span to 206 ft. (62.83 m.) as compared with 230 ft. (70.14 m.) for the B-36.

The YB-60 is powered by eight Pratt & Whitney J57 turbojet engines which are installed in pairs in "pods" suspended below and forward of the leading-edge of the wings.

DIMENSIONS.—
Span 206 ft. (62.83 m.).
Length 171 ft. (52.15 m.).
Height 50 ft. (15.25 m.).

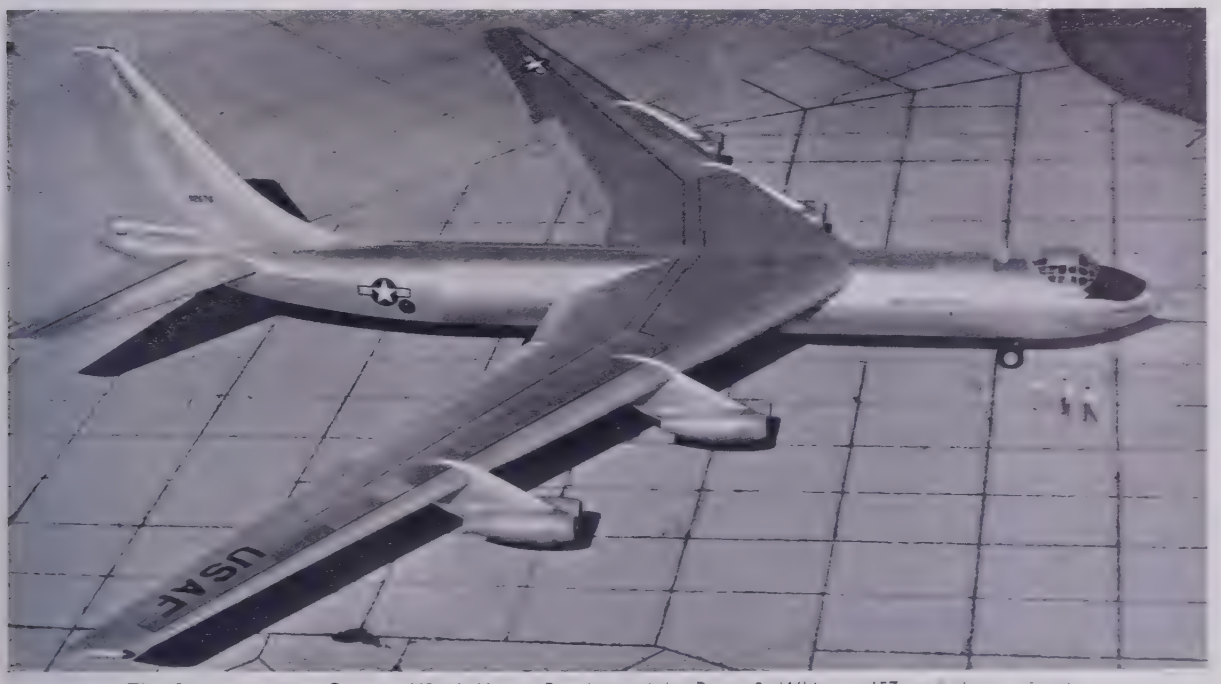
THE CONVAIR XB-58.

The designation XB-58 has been given to what has been described as a "multi-engined supersonic bomber" which is being developed by Convair under a U.S.A.F. experimental contract. Early in 1953 the U.S.A.F. announced that Convair had been directed to proceed further detail design studies for this aircraft which, it is understood, will be of delta-wing configuration and powered by eight turbojet engines. No further details are available.

THE CONVAIR B-36.

The B-36 is the largest military aircraft in service in the United States. It has been, or is being, built in the following versions :—

XB-36. First prototype. Originally fitted with two 110-in. (2.79 m.) single main landing gear wheels, but later equipped with the multi-wheel main gears introduced on the B-36A. In 1950 the XB-36 was fitted with an experimental track-tread landing-gear. First flew on August 8, 1946.



The first prototype Convair YB-60 Heavy Bomber (eight Pratt & Whitney J57 turbojet engines).



The Convair B-36D Heavy Bomber (six Pratt & Whitney R-4360 and four General Electric J47 engines).

YB-36. Production prototype. Roof of crew compartment raised above fuselage top line for improved vision, re-location of crew stations and installation of nose turret. First flew on December 4, 1947.

B-36A. Six 3,000 h.p. Pratt & Whitney R-4360 engines. First production model. Single main wheels of prototypes replaced by four-wheel bogies to reduce structure weight and improve weight distribution on runways. Twenty-two built. Originally without armament and used for training and type familiarisation. Modified into RB-36E (which see).

B-36B. Second production model. Six 3,500 h.p. Pratt & Whitney R-4360-41 engines with water-injection. Fully-equipped for combat with full armament. First flew on July 8, 1948. Last of 130 B-36B's modified by Convair to RB-36D standard, with additional jet power and installation of latest radar and electronic equipment, delivered to U.S.A.F. in December, 1951.

B-36D. Third production model. B-36B with additional power primarily to increase speed over target area. Has four General Electric J47 turbojet engines in pairs in "pods" under outer wings to supplement the six 3,500 h.p. R-4360-41 engines. Prototype, a converted B-36B with four Allison J35 engines, first flew on March 26, 1949. Over-target speed of B-36D with J47 turbojets increased to over 435 m.p.h. (696 km.h.). Has new snap-action bomb-bay doors instead of sliding type used in earlier models. Maximum gross weight 358,000 lb. (162,390 kg.).

RB-36D. Long-range strategic reconnaissance version of B-36D. Same defensive armament. Fourteen cameras in rear bomb-bay. First flight on December 18, 1949.

RB-36E. B-36A modified for strategic reconnaissance. Re-engined with six 3,500 h.p. R-4360-41 engines and fitted with additional jet-power as for B-36D.

B-36F. Six 3,800 h.p. Pratt & Whitney R-4360-53 engines, plus four J47 jet engines. Fourth production model.

RB-36F. Long-range reconnaissance version of B-36F.

B-36H. Six 3,800 h.p. Pratt & Whitney R-4360-53 engines plus four J47 turbojets. Fifth production model, incorporating new two-station flight-engineer's panel and improved radar, electronic and night-lighting equipment. In production into 1954 at Fort Worth.

RB-36H. Long-range reconnaissance version of B-36H.

The following detailed information applies to the B-36H.

TYPE.—Ten-engined Heavy Bomber.

WINGS.— Shoulder-wing cantilever monoplane. NACA laminar-flow wing section. Aspect ratio 11. Wing mounted slightly forward of mid point of fuselage. All-metal structure with stressed skin. Leading-edge sweepback 15° 6.5′, trailing-edge sweepback 3°. Gross wing area 4,772 sq. ft. (443.3 m.²). Statically-balanced ailerons with controllable trim-tabs. Electrically-operated trailing-edge flaps in three sections on each side of fuselage. Total flap area 519 sq. ft. (48.2 m.²). Heated surface anti-icing.

FUSELAGE.— Circular section all-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Tailplane span 73 ft. 5 in. (22.38 m.). Total horizontal area 978 sq. ft. (90.85 m.²). Total vertical area 542 sq. ft. (50.34 m.²). Thermal anti-icing in leading-edges of tailplane and fin.

LANDING GEAR.—Retractable tricycle type. Main gear consists of two four-wheel bogies on single shock-absorber struts, each unit retracting inwards into wing. Twin nose wheel gear raised forward into fuselage. Hydraulic retraction. Wheel track 46 ft. (14 m.), wheel base 59 ft. (18.0 m.).

POWER PLANT.—Six 3,800 h.p. Pratt & Whitney R-4360 twenty-eight cylinder radial air-cooled piston engines and four General Electric J47 turbojet engines (5,200 lb.= 2,360 kg. s.t. each). Piston engines mounted as pushers aft of rear spars and drive Curtiss Electric three-blade constant-speed full-feathering and reversing propellers with hollow steel blades and thermal anti-icing. Propeller diameter 19 ft. (5.79 m.). Each engine fitted with two turbo superchargers. Inlets for induction and cooling air in and below leading-edge of wings. Turbojet engines are paired in pods under the outer wings. Wing fuel tanks with total capacity of over 21,000 U.S. gallons (79,380 litres). Oil capacity over 1,200 U.S. gallons (4,542 litres).

ACCOMMODATION.—Crew of sixteen, including 5-man relief crew. Pressurised crew compartments forward and aft of bomb-bay with pressurised intercommunication tunnel 85 ft. (25.9 m.) long and 25 in. (0.63 m.) in diameter on left side of fuselage and below wings. Four-wheel truck for passage through tunnel. Thermal anti-icing and de-frosting for pilot's and bombardier's compartments and for gun-sighting blisters in rear crew compartment. Total pressurised fuselage volume 3,924 cub. ft. (111 m.³).

ARMAMENT AND EQUIPMENT.—Six retractable remotely-controlled turrets, each mounting twin 20 mm. cannon, plus two 20 mm. cannon on flexible mounting in nose and two



The Convair RB-36E Long-range Strategic Reconnaissance Monoplane. (*Warren Bodie*).



The Convair RB-36H Long-range Strategic Reconnaissance Monoplane.

in radar-controlled tail turret. Four-section bomb-bay with total volume of 12,300 cub. ft. (348 m.³). Designed bomb load for 10,000 mile range, 10,000 lb. (4 540 kg.). Maximum bomb load 84,000 lb. (38,140 kg.).

DIMENSIONS.—
Span 230 ft. (70.14 m.).
Length 162 ft. (49.4 m.).
Height 46 ft. 9 in. (14.26 m.).

WEIGHTS AND LOADINGS.—
Max. gross weight 358.000 lb. (162,530 kg.).
Wing loading 75 lb./sq. ft. (366 kg./m.²).

PERFORMANCE. –
Max. speed over 435 m.p.h. (696 km.h.).
Stalling speed 95 m.p.h. (152 km.h.).
Service ceiling over 45,000 ft. (13,725 m.).
Max. designed range 10,000 miles (16,000 km.).
Take-off to 50 ft. (15.25 m.) 1,666 yards (1,523 m.).

THE CONVAIR-LINER 340.

Although based on the Model 240, the Convair-Liner 340 is largely a new aircraft with greater wing span and area, a longer fuselage, more powerful engines, greater all-up weight and many interior design improvements.

The fuselage of the 340 is the same diameter as that of the 240 but is 54 in. (1.37 m.) longer, achieved by inserting a 16 in. (0.40 m.) section forward and a 38 in. (0.96 m.) section aft of the wings. This extra length permits the introduction of four additional seats, or it can be used for cargo purposes.

By the beginning of 1953, Convair had received orders for over 175 Convair-Liner 340's. Among the operators which have placed orders are United Air Lines, Braniff Airways, Delta Air Lines, Continental Air Lines, National Airlines, Hawaiian Airlines, Aramco, Garuda Indonesian Airways, Finnish Air Lines (Aero O/Y), Philippine Air Lines, K.L.M., Aeronaves de Mexico, Cia. Mexicana de Aviacion, Avensa (Venezuela), Jugoslovenski Aerotransport (JAT), Servicos Aereos Cruzeiro do Sul (Brazil), Alitalia, The Texas Company, Phillips Petroleum Company, Pratt & Whitney Aircraft.

The Convair 340 received its Approved Type Certificate on March 28, 1952, at an authorised gross weight of 47,000 lb. (21,340 kg.).

By March 1, 1953 Convair had delivered 53 of the transports and deliveries at the rate of eight per month were scheduled for the remainder of the year.

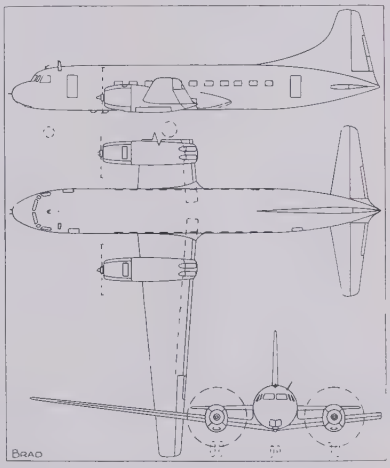
TYPE.—Twin-engined medium-range Airliner.

WINGS.—Low-wing cantilever monoplane. All-metal structure with stressed-skin covering. Thermal anti-icing. Aspect ratio 12. Mean aerodynamic chord 9 ft. 8.6 in. (2.97 m.). Wing area 920 sq. ft. (85.5 m.²).

FUSELAGE.—Circular section all-metal structure with stressed-skin covering.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Rudder and elevators fitted with trim and servo-control tabs. Thermal anti-icing for leading-edges of fin and tailplane.

LANDING GEAR.—Retractable tricycle type. All three units fitted with twin wheels.



The Convair-Liner 340.

Steerable nose wheel with the two wheels keyed to common axle so that wheel and axle rotate as a unit to eliminate shimmy and need for damper. Both struts and wheels designed for installation of Westinghouse Decelostat anti wheel-skid units. Wheel track 25 ft. (7.62 m.).

POWER PLANT.—Two Pratt & Whitney R-2800-CB16 eighteen-cylinder radial air-cooled engines, each rated at 1,800 h.p. at 8,500 ft. (2,590 m.) in low blower and 1,700 h.p. at 14,500 ft. (4,240 m.) in high blower and with 2,400 h.p. available for take-off (with water injection). Engines mounted in aerodynamically-clean nacelles incorporating what is known as "aspirated cooling." Air after passing through cylinder blocks enters a venturi section into which the exhaust gases are also ejected, the effect being to increase flow of cooling air. Air/exhaust mixture in a ratio of about 5/1 is ejected via twin tail-pipes above rear end of nacelle. Exhaust gas augmentation is claimed to give an increase in speed of about 10-12 m.p.h. (16-19.2 km.h.). Hamilton Standard Hydromatic constant-speed feathering and reversing airscrews, diameter 13 ft. 1 in. (4 m.). Integral fuel tanks outboard of engine nacelles. Maximum fuel capacity 1,750 U.S. gallons (6,615 litres). Provision for underwing refuelling.

ACCOMMODATION.—Crew of three/four. Cabin seats forty-four passengers in pairs on each side of central aisle. Integral self-contained stairway located forward of wings on port side. Cabin is pressurised and both air and sound conditioned. Radiant-wall heating and refrigeration maintains constant cabin temperature in the air and on the ground. Cargo compartment fore and aft of cabin, and below cabin floor forward of wings, with all access doors on starboard side.

DIMENSIONS.—
Span 105 ft. 4 in. (32.12 m.).
Length 79 ft. 2 in. (24.14 m.).
Height (over tail) 28 ft. 2 in. (8.59 m.).
Wing area 920 sq. ft. (85.5 m.²).

WEIGHTS AND LOADINGS.—
Weight empty 29,486 lb. (13,382 kg.).
Max. gross take-off weight 47,000 lb. (21,338 kg.).
Max. landing weight 46,000 lb. (20,884 kg.).
Max. T.O. wing loading 51.08 lb./sq. ft. (249.27 kg./m.²).



The Convair-Liner 340 Airliner (two 2,400 h.p. Pratt & Whitney R-2800-CB16 engines).



The Convair-Liner 240 Airliner (two 2,400 h.p. Pratt & Whitney R-2800-CA18 engines).

Max. T.O. power loading 9.8 lb./h.p. (4.44 kg./h.p.).

PERFORMANCE.

Cruising speed (1,200 h.p. per engine) at 18,000 ft. (5,490 m.) 284 m.p.h. (448 km.h.).

Range with 200 miles (320 km.) plus ¾-hour reserve; 1,200 h.p. per engine; 10 m.p.h. (16 km.h.) head wind; 44 passengers and baggage; 1,157 U.S. gallons (4,373 litres) of fuel 2,015 miles (3,225 km.).

Max. CAR operating height with one engine inoperative 9,000 ft. (2,745 m.).

Required CAR runway length for T.O. at max. T.O. weight 4,675 ft. (1,425 m.).

Required CAR runway length for landing S/L. at max. landing weight 4,500 ft. (1,370 m.).

THE CONVAIR-LINER 240.

The Convair-Liner 240 was the first post-war commercial transport designed by Consolidated Vultee and was evolved primarily to serve as a DC-3 replacement. The prototype first flew at San Diego on March 16, 1947, and certification by the C.A.A. followed in November, 1947.

Approximately 175 Convair-Liner 240's were built, most of which were delivered to, and are still in service with, the following airlines :—American Airlines; Western Air Lines; Pan American World Airways; Canadian Pacific Air Lines; Linee Aeree Italiane (LAI); K.L.M. (Royal Dutch Airlines); Trans-Australia Airlines; Aerolineas Argentinas; Orient Airways (India); Swissair; Sabena (Belgian Airlines); Northeast Airlines; Garuda Indonesian Airways and Ethiopian Airlines.

A full structural description of the 240 Convair-Liner has been published in previous editions of "All the World's Aircraft."

TYPE. Twin-engined medium-range Airliner.

POWER PLANT.—Two Pratt & Whitney R-2800-CA18 eighteen-cylinder radial air-cooled engine rated at 1,900 h.p. at 4,000 ft. (1,220 m.) in low blower and 1,675 h.p. at 13,500 ft. (4,120 m.) in high blower and with 2,400 h.p. available for take-off (with water injection). Either Hamilton Standard Hydromatic or Curtiss Electric constant-speed feathering and reversing airscrews, diameter 13 ft. 1 in. (4 m.). Integral fuel tanks outboard of engine nacelles. Maximum fuel capacity 1,550 U.S. gallons (5,860 litres).

ACCOMMODATION.—Crew of three/four. Cabin seats forty (40) passengers in pairs on each side of central aisle.

DIMENSIONS.—

Span 91 ft. 9 in. (27.98 m.).

Length 74 ft. 8 in. (22.77 m.).

Height 26 ft. 11 in. (8.22 m.).

WEIGHTS AND LOADINGS.—

Weight empty 27,600 lb. (12,530 kg.).

Payload 9,350 lb. (4,245 kg.).

Weight loaded 41,790 lb. (18,972 kg.).

Landing weight 39,800 lb. (18,070 kg.).

Wing loading (T.O.) 51.2 lb./sq. ft. (249.8 kg./m.²).

Power loading (T.O.) 8.7 lb./h.p. (3.95 kg./h.p.).

PERFORMANCE.—

Max. speed 347 m.p.h. (538 km.h.) at 16,000 ft. (4,880 m.).

Cruising speed 270 m.p.h. (432 km.h.) at 16,000 ft. (4,880 m.).

Landing speed (full flaps and power off) 88 m.p.h. (140 km.h.).

Service ceiling 30,000 ft. (9,150 m.).

Operational ceiling at 40,000 lb.=17,360 kg. on one engine 8,500 ft. (2,590 m.).

Range (with ATA reserve) at 270 m.p.h. (432 km.h.) cruising speed 1,800 miles (2,880 km.).

THE CONVAIR T-29.

In 1948 Convair began the military conversion of the Convair-Liner 240 to serve as an aircrew trainer for the U.S.A.F. under the designation T-29. The following versions of the T-29 have been or are being built :—

T-29A. Original Convair-Liner 240 crew trainer conversion. Non-pressurised but fitted with oxygen equipment for high-altitude training, permitting 6 hour's duration at 20,000 ft. (6,100 m.) at 250 m.p.h. (400 km.h.). Cabin has fourteen fully-equipped stations for students and one radio operator's station. Each student has access to a map table, Loran scope, altimeter indicator and radio compass panel. In roof of fuselage are four astrodomes. Five drift-meters also included. All T-29A's later modified with additional outer wing fuel tanks for increased range at operational height.

T-29B. Development of T-29A with pressurised cabin, increased fuel capacity and greater A.U.W. of 43,575 lb. (19,780 kg.) compared with 40,500 lb. (18,390 kg.) of T-29A. Major external difference is the fitting of three astrodomes and one periscopic sextant on top of fuselage instead of the four astrodomes of the A Series.

T-29C. Similar to T-29B but fitted with two advanced model 2,500 h.p. Pratt & Whitney R-2800 engines.

T-29D. Similar to T-29C but equipped for bombardier training. Completely new interior for new training function. Only external difference compared with T-29B is the absence of astrodomes.

VT-29E. This designation covers four Convair-Liner 240 personnel transports for MATS use. Two are furnished for V.I.P. use and two have standard high-density seating.

The following data refers specifically to the T-29B which is powered with two 2,400 h.p. Pratt & Whitney R-2800 engines.

DIMENSIONS.—

Span 91 ft. 9 in. (27.98 m.).

Length 74 ft. 8 in. (22.77 m.).

Height over tail 26 ft. 11 in. (8.22 m.).

Wing area 817 sq. ft. (75.9 m.²).



The Convair T-29B Aircrew Trainer (two 2,400 h.p. Pratt & Whitney R-2800 engines).

WEIGHT.—
T.O. weight 43,575 lb. (19,780 kg.).
PERFORMANCE.—
Max. speed 300 m.p.h. (480 km.h.).
Average cruising speed 348 m.p.h. (297 km.h.).
Stalling speed (with flaps) 87.4 m.p.h. (140 m./min.).
Initial rate of climb 1,230 ft./min. (375 m./min.).
Service ceiling 23,500 ft. (7,170 m.).
Service ceiling on one engine 8,850 ft. (2,700 m.).
Cruising range 1,500 miles (2,400 km.).
T.O. distance to 50 ft. (15.25 m.) 906 yds. (830 m.).
Landing distance from 50 ft. (15.25 m.) 780 yds. (714 m.).

THE CONVAIR C-131 SAMARITAN.

The C-131 is a military transport version of the Convair-Liner which exists in the two following versions :—

C-131A. Air evacuation and cargo transport based on the Convair-Liner 240. Fully pressurised. Alternative accommodation for 40 passengers in backward-facing seats, or 27 stretcher cases, or cabin can be stripped for all-cargo carrying. Hydraulically-operated loading door on port side aft of wings.

C-131C. Air evacuation and cargo transport based on Convair-Liner 340. Quickly adaptable for personnel, cargo or ambulance duties. Large 120-in. (3.05 m.) loading door on port side aft of wings. Floor stressed for loading of 200 lb./sq. in. (14 kg./cm.²). Increased fuel. Standard loaded weight : 48,000 lb. (21,800 kg.).

THE CONVAIR YC-135.

The designation YC-135 has been given to two Convair 340's, each to be powered by two 3,750 h.p. Allison T56 turboprop engines. They are due to be delivered to the U.S.A.F. in the Spring of 1954 for test and evaluation. The gross weight of the YC-135 will be 53,200 lb. (24,153 kg.) as it is estimated that it will have a maximum speed of 335 m.p.h. (536 km.h.) and a cruising altitude of 30,000 ft. (9,150 m.).

CUSTER

CUSTER CHANNEL WING CORPORATION.

HEAD OFFICE : ROUTE 4, HAGERSTOWN, MARYLAND.

President and General Manager : W. R. Custer.

Vice-President : L. E. Roelke.

Secretary and Treasurer : E. S. Summers.

The Custer Channel Wing Corpn. has been formed to develop a type of wing for which the company claims, among other things, that it will enable an aircraft to take-off in a few feet, rise vertically and hover ; permit forward speeds in excess of those of conventional aircraft ; and will allow an aircraft to slow down, hover and land vertically under full control.

An experimental aeroplane with the channel wing was demonstrated in flight in December, 1951, and a similar prototype has more recently been submitted to tests in the NACA full-scale wind tunnel at Langley Field, Va. These tests were mainly concerned in studying the low speed lift-producing characteristics of the channel wing, as well as its stability and control properties at zero and low speeds at high angles of attack.



The Custer CCW-5 Channel-wing Monoplane on its first flight.

The report on these tests does not support the claims made by the company for its wing. In summary, the report declares that the flow of air through the channel wing is rough and partially stalled, that the aircraft will fly but not hover ; that single-engine performance would be impossible and that the power-off glide path would be very steep in comparison with contemporary aircraft of normal design.



Two views of the Custer CCW-5 (two 280 h.p. Continental SO-470 engines).

THE CUSTER CCW-5

The latest aircraft employing the channel wing is the CCW-5 which is, in effect, a modified five-seat Baumann Brigadier powered by two 280 h.p. Continental SO-470 engines driving Hartzell constant-speed pusher airscrews. This aircraft, the general arrangement of which can be seen in the accompanying illustrations, was built by the Baumann Aircraft Corpn. for the Custer Channel Wing Corpn. It made its maiden flight at Oxnard, California, on July 13, 1953.

DIMENSIONS.—
Span 41 ft. 2 in. (12.55 m.).
Length 28 ft. 8½ in. (8.76 m.).
Height 10 ft. 10 in. (3.30 m.).
WEIGHTS (designed).—
Weight empty 3,000 lb. (1,360 kg.).
Disposable load 2,400 lb. (1,090 kg.).
Weight loaded 5,400 lb. (2,450 kg.).

DOMAN

DOMAN HELICOPTERS, INC.

HEAD OFFICE AND WORKS : MUNICIPAL AIRPORT, DANBURY, CONNECTICUT.

Established : August 31, 1945.

Chairman of the Board and President : Glidden S. Doman.

Director of Engineering : Thomas E. Zeerip.

Director of Research and Development : Stephen du Pont.

Chief Design Engineer : John W. Mazur.

Treasurer : Harry L. Brown.

Doman Helicopters, Inc., formerly known as Doman-Frasier Helicopters, Inc., was formed to develop a helicopter embodying new principles established by its engineers. These include a hingeless rotor unit in which the blades are dynamically flexible but otherwise unarticulated, a hydraulic rotor control system, and a rotor mechanism contained within a housing with circulating oil lubrication provided for all moving parts.

A complete rotor and control system designed and manufactured by the company was installed on a U.S.A.F. R-6 helicopter, and this combination, which is designated LZ-1A, has been stress and endurance tested under a service contract with the U.S.A.F. Wright Field Laboratories, and is still being flown as a test aircraft.

The first helicopter of completely Doman design, the LZ-4, was bought by the Curtiss-Wright Corporation and is constantly being flown and operated by that organisation.

The latest Doman helicopter, the LZ-5, has been ordered for service trials by the U.S. Army Field Forces. Doman also expects C.A.A. certification for the LZ-5 before the end of 1953.

Doman has licenced Hiller Helicopters, Inc. of Palo Alto, Cal., to build the military H-31 version of its helicopter, while it will continue to develop and manufacture the LZ-5 commercial model.

THE DOMAN LZ-5.

U.S. Air Force designation: YH-31.

TYPE.—General Utility Helicopter.

ROTOR SYSTEM.—One four-blade main rotor and one three-blade anti-torque and steering tail rotor. Main rotor of hingeless type, articulation for aerodynamic flapping being provided by gimbal-mounting the hub. The hub is a four-spoked forging and above hub is a planetary reduction gear assembly. The sun gear is splined to the drive shaft, the ring gear is secured to the non-rotating gimbal ring and the planet carrier is attached to the rotor hub. A common housing encloses the

reduction gearing, swash plate and rotor mechanism, with lubrication by circulating oil. Each blade has a spar of plastic bonded birch laminates and a plastic-bonded mahogany ply covering. Entire leading-edge is armoured with stainless steel and the trailing-edge is of extruded nylon which serves as a trim-tab. Near the root the bending and torsion loads of the laminated spar are transferred to a tubular steel spar, the root of which is secured in the hub housing by a bearing pack similar to propeller practice. Main rotor blade area (each) 18.4 sq. ft. (1.71 m.²). Total disc area 1,810 sq. ft. (16.81 m.²) Anti-torque rotor blades rigidly attached to gimbal-mounted hub. Total disc area of anti-torque rotor 63.6 sq. ft. (5.91 m.²).

FUSELAGE.—Welded steel-tube structure covered with magnesium sheet.

LANDING GEAR.—Four-wheel type. Doman air-oil shock absorbers. Goodyear wheels and tyres. Track 7 ft. 2 in. (2.18 m.). Wheelbase 7 ft. 9 in. (2.35 m.).

POWER PLANT.—One 400 h.p. Lycoming SO-580-B eight-cylinder horizontally-opposed air-cooled engine mounted in nose of fuselage with crankshaft centre-line inclined up and aft at 32 degrees. Fluid drive with mechanical lock-up on engine crankshaft flange coupled to inclined tubular drive shaft equipped with universal joints. Tail rotor drive from take-off gear in main rotor. Main rotor/engine r.p.m. ratio 16.45 : 1. Anti-torque rotor, engine r.p.m. ratio 3.154 : 1. Fuel tankage in floor beam structure of main cabin section. Total fuel capacity 110 U.S. gallons (416 litres). Oil capacity 4 U.S. gallons (15 litres).

ACCOMMODATION.—Pilot's compartment in nose above engine seating two side-by-side. Cabin may seat up to six or accommodate four stretchers. Cabin is 8 ft. 4 in. (2.54 m.) long, 5 ft. (1.52 m.) wide and 5 ft. 11 in. (1.82 m.) high. Non-structural windowed side panels of cabin easily detachable for loading bulky objects. Side doors in panels for normal entrance.

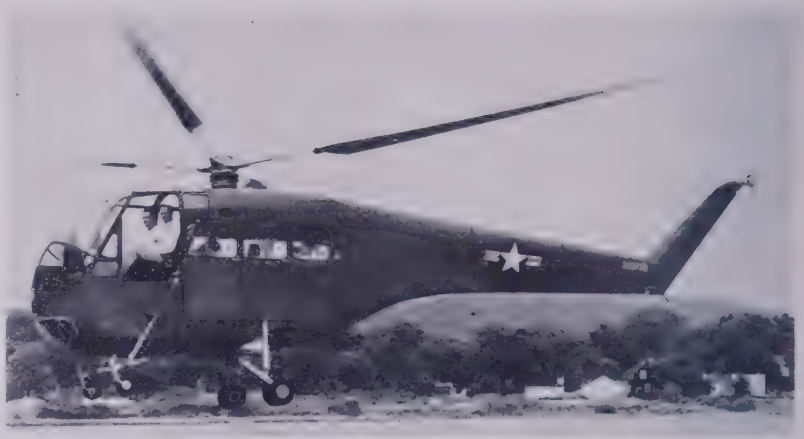
DIMENSIONS.—
Main rotor diameter 48 ft. (14.64 m.).
Length of fuselage 37 ft. 10 in. (11.54 m.).
Overall width 5 ft. (1.52 m.).
Height (to top of rotor pylon) 10 ft. 3 in. (3.12 m.).
Anti-torque rotor diameter 9 ft. (2.74 m.).

WEIGHTS (YH-31).—
Weight empty 2,860 lb. (1,298 kg.).
Disposable load 1,559 lb. (708 kg.).
Weight loaded 4,419 lb. (2,006 kg.).

WEIGHTS (LZ-5 Commercial Model).—
Weight empty 2,860 lb. (1,298 kg.).
Disposable load 2,140 lb. (972 kg.).
Weight loaded 5,000 lb. (2,270 kg.).

PERFORMANCE (YH-31 at 4,419 lb.=2,006 kg. A.U.W.).—
Max. speed 104 m.p.h. (166.4 km.h.).
Cruising speed 86 m.p.h. (137.6 km.h.).
Max. rate of climb 1,300 ft./min. (396 m./min.).
Hovering ceiling (no ground effect) 8,500 ft. (2,590 m.).
Hovering ceiling (in ground effect) 13,000 ft. (3,965 m.).
Service ceiling 18,000 ft. (5,490 m.).
Retrieving radius for two stretcher patients 240 miles (384 km.).
Max. endurance 3.7 hours.

PERFORMANCE (LZ-5 at 5,000 lb.=2,270 kg. A.U.W.).—
Max. speed 98 m.p.h. (156.8 km.h.)
Cruising speed 86 m.p.h. (137.6 km.h.).
Hovering ceiling (no ground effect) 4,000 ft. (1,220 m.).
Hovering ceiling (in ground effect) 8,000 ft. (2,440 m.).



The Doman YH-31 Helicopter (400 h.p. Lycoming SO-580-B engine).

DOUGLAS

THE DOUGLAS AIRCRAFT COMPANY, INC.

HEAD OFFICE AND WORKS: SANTA MONICA, CALIFORNIA.

OTHER WORKS: EL SEGUNDO AND LONG BEACH, CAL, AND TULSA, OKLAHOMA.

Established: 1920. (Reorganized: 1928).

President: Donald W. Douglas.

Senior Vice-President: Frederick W. Conant.

Vice-President—Engineering: A. E. Raymond.

Vice-President—Commercial Sales: Nat Paschall.

Vice-President—Military Sales: Donald W. Douglas, Jr.

Vice-President—Tulsa Division: Harry Woodhead.

Vice-President—Santa Monica Division: L. A. Carter.

Vice-President—El Segundo Division: T. E. Springer.

Executive Secretary: L. E. Tollefson.

Treasurer: Harry W. Strangman.

SANTA MONICA DIVISION.

General Manager: L. A. Carter.
Works Manager: H. W. Thue.
Chief Engineer: E. F. Burton.

EL SEGUNDO DIVISION.

General Manager: T. E. Springer.
Chief Engineer: E. H. Heinemann.

LONG BEACH DIVISION.

General Manager: Jock Simpson.
Works Manager: K. G. Farrar.
Chief Engineer: John C. Buckwalter.

TULSA DIVISION.

General Manager: Harry Woodhead.
Works Manager: H. G. Hynd.
Chief Engineer: D. E. Dunlap.

The Douglas Aircraft Company has occupied the present factory site at Clover Field, Santa Monica, Cal., since 1928. It also operates plants at El Segundo, nine miles from the main plant, and at Long Beach, 25 miles away.

Early in 1951, the company also reactivated a plant at Tulsa, Oklahoma, which it operated as a bomber plant during World War II. Douglas will produce the Boeing-designed B-47 Stratojet bomber at Tulsa.

Military production during 1953 was mainly concerned with the AD series Skyraider torpedo-dive bomber and F3D twin-jet night fighter for the U.S. Navy and the C-124 Globemaster II four-engined troop and cargo transport for the U.S. Air Force. The XA2D-1, a turboprop-powered attack aircraft designed as a successor to the AD Skyraider, was under development for the U.S. Navy and the XF4D Skyray delta-wing fighter was being tested in preparation for production for the U.S. Navy. The XA3D-1 twin-jet swept-wing carrier-based attack bomber flew for the first time on October 28, 1952.

The Douglas company is engaged on an extensive programme of development which includes conventional military aircraft of advanced design, supersonic research aircraft, guided missiles, rockets, etc.

Under contracts and sub-contracts with the U.S. Navy meteorological sounding rockets have been developed and fired to heights of 230,000 ft. (70,150 m.).

THE DOUGLAS X-3.

The X-3 high-speed research aircraft, which has been built under a contract placed with Douglas by the U.S.A.F. in 1947, is the first piloted aircraft designed to take-off under its own power and operate at sustained supersonic speeds in level flight.

Its design and construction presented problems of unprecedented complexity, including the use of titanium and the development of special techniques for its fabrication.

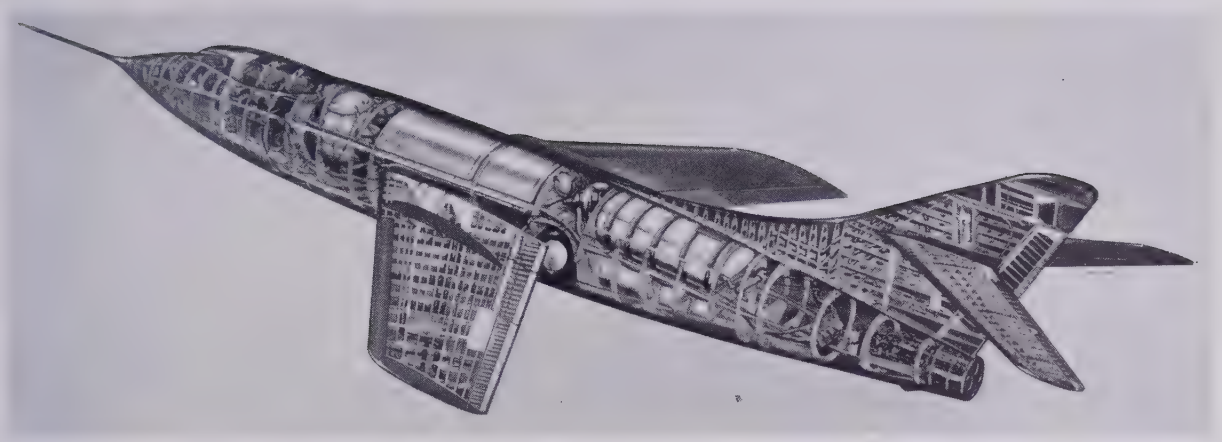
The X-3 was successfully test-flown on October 20, 1952, at the Edwards Air Force Base, Muroc, Cal.

THE DOUGLAS D-558-1 AND 2.

In 1945 the Douglas company undertook to develop for the U.S. Navy Bureau of Aeronautics, in conjunction with NACA, a series of high-speed research



The Douglas D-558-2 Skyrocket Research Monoplane, the fastest aeroplane in the World. (*Gordon Williams*).



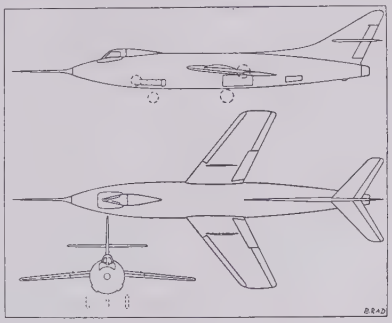
A sectional drawing of the Douglas D-558-2 Skyrocket Research Monoplane.

aircraft with which to obtain in free flight air load measurements and other related data then unobtainable in existing wind tunnels.

The first design, the D-558-1 Skystreak, was a straight-wing aircraft powered with an Allison J35-A-23 turbojet engine. The first of three Skystreaks made its first flight on May 28, 1947, and less than three months later—on August 20—this aircraft set up a World's Speed Record of 640.663 m.p.h. (1,051 km.h.). Five days later the same aircraft raised the record to 650.606 m.p.h. (1,047 km.h.).

Shortly after the Skystreak development had started it was considered advisable to modify the original contract to include the investigation of swept-back wings and a second design, the D-558-2 Skyrocket, was put in hand. The first of three Skyrockets made its maiden flight on February 4, 1948. As the full realisation of the advantage of the swept-back wing at high speeds could not be obtained by using the largest jet engine then available, a supplementary rocket motor was included in the power-plant. The Westinghouse J34 turbojet was mounted amidships, with flush side inlets forward and a flush exit beneath the fuselage, and a Reaction Motors bi-fuel rocket motor was installed in the extreme fuselage tail.

In August, 1951, one of the Skyrockets with its jet engine removed and its rocket fuel capacity doubled attained the highest speed and altitude ever recorded by a piloted aeroplane. The U.S. Navy has confirmed that a speed of 1,238 m.p.h. (1,981 km.h.) and an altitude of 79,494 ft. (24,245 m.) were reached on two separate flights made within a week of each other. On both occasions the Skyrocket was carried to an altitude of 35,000 ft. under a Boeing P2B-1 carrier aircraft before being released.



The Douglas D-558-2 Skyrocket.

A little over a year later, on August 28, 1953, a Skyrocket, after being released from its carrier at about 34,000 ft., climbed to a new record height of 83,235 ft. (25,387 m.).

The three Skyrockets are now engaged in the second phase of a planned research programme operated by the National Advisory Committee for Aeronautics at its High Speed Research Station at Muroc Dry Lake, California.

Both the Skystreak and Skyrocket have been fully illustrated and described in previous editions of "All the World's Aircraft."

THE DOUGLAS GLOBEMASTER II.
U.S.A.F. designation: C-124.

The C-124A, which is now in production for the U.S.A.F., is an extensively modified version of the C-74 and uses the wings, tail-unit, power-plant and a number of other service-tested features of that aircraft. With a gross weight of 175,000 lb. (79,450 kg.) it is nearly two and a half times heavier than the C-54 Skymaster.

The following versions of the Globemaster II have been mentioned :—

YC-124. Prototype. Four 3,000 h.p. Pratt & Whitney R-4360-35 engines driving four-blade airscrews. First flew on November 27, 1949.

C-124A. Production model. Four 3,500 h.p. Pratt & Whitney R-4360-20W engines driving Curtiss three-blade feathering and reversible airscrews 16 ft. 7 in. (5.06 m.) in diameter.

YC-124B. One Globemaster being fitted with four 5,500 h.p. Pratt & Whitney YT34-P-1 turboprop engines. Pressurised flight compartments.

C-124C. Four 3,800 h.p. Ford-built Pratt & Whitney R-4360-63 engines. Development of C-124A. Current production version.

C-124X. Improved version of YC-124B designed to take full advantage of its turboprop power-plant. Will have completely pressurised fuselage. The many major modifications will include the removal of the main loading doors from the nose to the rear fuselage, with new rear fuselage and tail design. Strengthened wings and landing-gear. Understood that it will be re-designated XC-133.

The description below refers to the C-124A.

TYPE.—Four-engined Military transport.

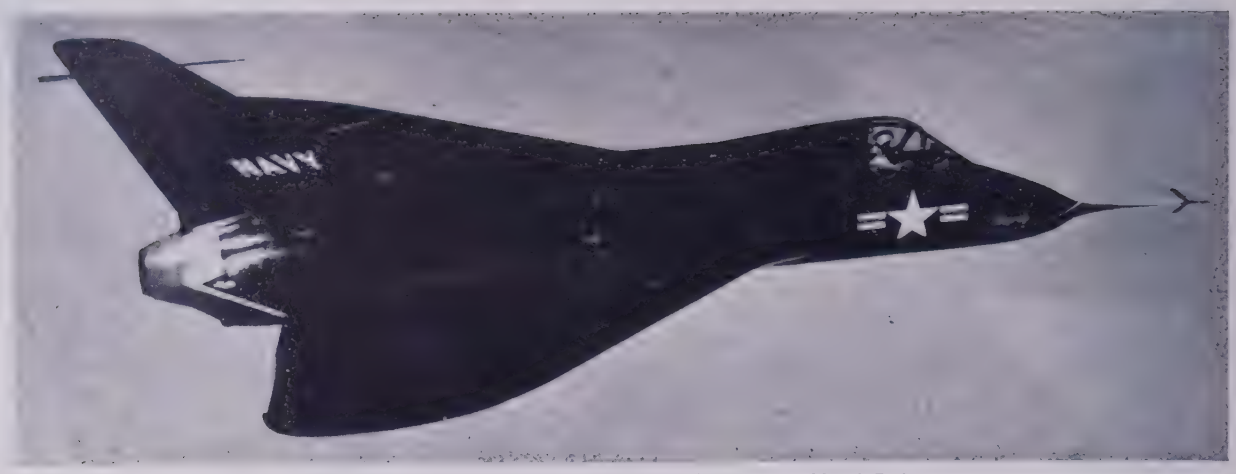
WINGS.—Cantilever low-wing monoplane. Low-drag laminar flow aerofoil section. All-metal two-spar stressed-skin structure. Centre-section span 101 ft. 8 in. (30.99 m.). Full-span Fowler-type flaps, outer sections of which act as ailerons. Thermal de-icing with heating units in streamline casings at wing-tips.

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure with stressed skin over fin and tailplane and fabric covering on statically-balanced rudder and elevators. Trim-tab in rudder and trim and balance-tabs in elevators. Tailplane span 53 ft. 0 in. (16.15 m.).



The Douglas C-124A Globemaster II Military Transport (four 3,500 h.p. Pratt & Whitney R-4360 engines). (*Harold Martin*).



The Douglas XF4D-1 Skyray Single-seat Delta-wing Naval Fighter.

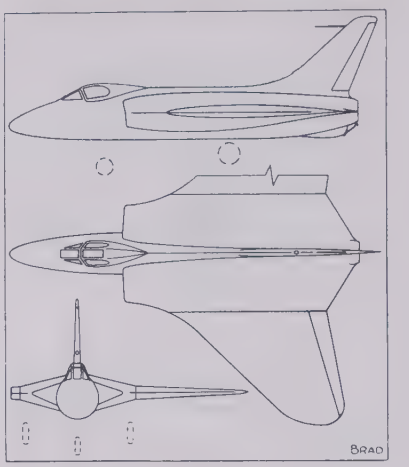
LANDING GEAR.—Retractable tricycle type. All units have dual wheels. Track (centre-lines of legs) 34 ft. 2 in. (10.41 m.). Wheel base 37 ft. 3 in. (11.35 m.). Emergency bumper skid under rear fuselage.

POWER PLANT.—Four 3,500 h.p. Pratt & Whitney Wasp Major R-4360-20W twenty-eight-cylinder four-row radial air-cooled engines. Curtiss three-blade full-feathering and reversible airscrews, 16 ft. 7 in. (5.06 m.) in diameter. Entry doors in wing root and in each nacelle allow inspection of engines in flight. Maximum fuel capacity 11,000 U.S. gallons (41.532 litres) carried in six integral tanks in centre-section.

ACCOMMODATION.—Pilot's compartment seating two side-by-side in nose, with compartment immediately behind for flight-engineer, radio-operator and navigator. Galley, crew lavatory and relief crew compartment, with rest bunks, etc., further aft. Main cargo hold 77 ft. (23.48 m.) long, 12 ft. 10 in. (3.91 m.) high and 13 ft. (3.96 m.) wide, providing more than 10,000 cub. ft. (283 m.^{3}) of usable cargo space. Clamshell doors in nose ahead of nose-wheel provide an opening 11 ft. 8 in. (3.55 m.) high and 11 ft. 4 in. (3.45 m.) wide through which tracked or wheeled vehicles can be driven or rolled up built-in ramps. Electrically-operated elevator in middle of cargo hold, just aft of wing trailing-edge, provides additional loading and unloading facilities. Floor covered with 20 in. (50.8 cm.) grid pattern of heavy-duty tie down fittings. Two overhead travelling cranes, each lifting 8,000 lb. (3,629 kg.) or 16,000 lb. (7,258 kg.) run length of hold. For personnel transport interior of hold can be converted into a double-deck cabin with capacity for 200 troops and their field equipment. Fitted as an ambulance it can accommodate 127 stretcher cases, plus 52 sitting patients and medical attendants.

DIMENSIONS.—
Span 173 ft. 3 in. (52.78 m.).
Length 127 ft. 2 in. (38.78 m.).
Height 48 ft. 3 in. (14.72 m.).

WEIGHTS.—
Payload 50,000 lb. (22,700 kg.).
Weight loaded 175,000 lb. (79,450 kg.).



The Douglas XF4D-1 Skyray.

PERFORMANCE.—
Combat radius with 50,000 lb.=22,700 kg. payload 1,000 miles (1,600 km.).

THE DOUGLAS SKYRAY.
U.S. Navy Designation: F4D-1.

The F4D Skyray is a single-seat delta-wing tail-less monoplane which has been designed for the U.S. Navy as a supersonic carrier based interceptor fighter. The F4D was designed round the Westinghouse J40-WE-8 engine with afterburner, but owing to delays in the production of this engine the prototype XF4D-1 made its first flight on January 23, 1951, powered by an Allison J35 turbojet engine. It has since been re-engined with a Westinghouse J40. The production Skyray will be fitted with the Pratt & Whitney J57 engine.

At the beginning of 1953 production of the F4D was in its early stages at El Segundo.

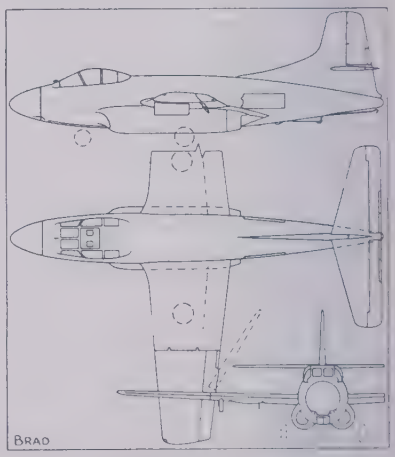
THE DOUGLAS SKYKNIGHT.
U.S. Navy designation: F3D.

The Skyknight is a two-seat jet-propelled carrier-based all-weather fighter, the prototype of which first flew on March 22, 1948.

F3D-1. First production version. Two Westinghouse J34-WE-38 turbojet engines (3,250 lb.=1,475 kg. s.t. each). First production aircraft flew on February 13, 1950.

F3D-2. Current production model. Designed, with larger nacelles, for Westinghouse J46 engines but first production aircraft fitted with J34 engines. Improved air-conditioning, wing spoilers for improved lateral control, thicker bullet-proof windscreen, new type of auto-pilot, etc. First F3D-2 flew on February 14, 1951. For U.S. Marine Corps.

The description which follows refers to the F3D-1.



The Douglas F3D-2 Skyknight.



The Douglas F3D-2 Skyknight Two-seat All-weather Fighter (*Warren Bodie*).



The prototype Douglas XA3D-1 Attack Bomber (two Westinghouse J40 turbojet engines).

TYPE.—Two-seat Naval All-weather Fighter.
WINGS.—Mid-wing cantilever monoplane. Laminar-flow wing section. All-metal stressed-skin structure. Wings fold upward for carrier stowage. Hydraulic folding. Slotted flaps inboard of ailerons.
FUSELAGE.—All-metal stressed-skin structure. Hydraulically-operated speed brakes, one on each side and one below fuselage aft of wings as in the AD Skyraider.
TAIL UNIT.—Cantilever monoplane type. Tailplane mounted on fin. All-metal stressed-skin structure.
LANDING GEAR.—Retractable nose-wheel type. Auxiliary tail-wheel under rear fuselage. Hydraulic retraction. Arrester hook under rear fuselage.
POWER PLANT.—Two Westinghouse J34-WE-38 axial-flow turbojet engines (3,250 lb.=1,475 kg. s.t.) mounted on lower edges of forward fuselage. After removal of cowlings engines may be lowered on to handling trucks with a standard bomb hoist. Complete engine change in 1 hour. Normal fuel in fuselage above engines and aft of cockpit. Auxiliary fuel may be carried in drop tanks under each wing near folding joints.
ACCOMMODATION.—Crew of two side-by-side in pressurised cockpit with flat armoured windscreen and armoured canopy. Cabin pressurisation and air-conditioning by AiResearch expansion turbine fed by engine compressors. Emergency exit through escape chute from rear wall of cabin to underside of fuselage, the hydraulically-operated lower chute door acting as windbreak. Hatch in canopy roof for escape in event of ditching.
ARMAMENT.—20 mm. cannon armament in lower nose below radome. Provision under wings for bombs, rockets and other armament stores.
DIMENSIONS (Approx.).—
Span 50 ft. (15.25 m.).
Length 45 ft. (13.72 m.).
Height 16 ft. (4.88 m.).
WEIGHTS AND PERFORMANCE.—
No data.

THE DOUGLAS XA4D-1.

The A4D is under development as a replacement for the AD Skyraider. It is understood that it will be powered by a Wright J65 Sapphire turbojet engine. No further details are available.

THE DOUGLAS A3D-1.

The A3D-1 is a twin-jet swept-wing carrier-based Attack Bomber. The most powerful aircraft ever designed for carrier operation, the A3D will be able to carry the largest types of bombs, torpedoes or other stores the U.S. Navy is expected to use in strike actions from carriers.

The shoulder-wing layout permits the installation of the two turbojet engines in pods, one on each side of the fuselage. Both the wings and vertical fin fold for handling and storage in carriers.

The pressurised cabin accommodates a crew of three—pilot, pilot-bombardier and gunner-navigator. A slide-type escape chute similar to that used in the F3D and an upper ditching hatch are provided for the crew.

The three wheels of the tricycle landing-gear retract with the fuselage fore and aft of the bomb bay. Hydraulically-operated AD-type fuselage-mounted dive brakes are used.

The prototype XA3D-1 flew for the first time on October 28, 1952, powered with two Westinghouse J40 engines. The production A3D will be fitted with Pratt & Whitney J57 engines.

THE DOUGLAS B-66 and RB-66.

The B-66 three-seat high-performance light bomber, which has been ordered into production by the U.S.A.F., is based on the A3D previously described, with design and engineering changes to modify the carrier-based aircraft design into a land-based bomber. The production B-66 and a reconnaissance version, the RB-66, will be powered by two Allison J71 turbojet engines. No other details are available.

THE DOUGLAS SKYSHARK

U.S. Navy Designation: XA2D-1.

The XA2D-1 Skyshark has been designed as a successor to the AD Skyraider and was the first U.S. post-war tactical aeroplane to be powered with a turboprop engine. It was originally intended that the Skyshark should incorporate as many parts of the Skyraider as possible but the ever-changing strength, stability and equipment requirements made redesign of most of the airframe components necessary. The wing span and area were retained but the wing and tail surface thicknesses were decreased, strength and stroke of the landing-gear increased and so forth. The Skyshark however, does retain the family characteristics of the AD, particularly with regard to the wing planform, tail configuration and landing-gear arrangement.

The XA2D-1 is powered with an Allison T40-A-2 engine, which drives two three-blade Aeroproducts co-axial contra-rotating airscrews through a common gear-box. Either one of the two turbine



The prototype Douglas XA3D-1 Attack Bomber (two Westinghouse J40 turbojet engines).



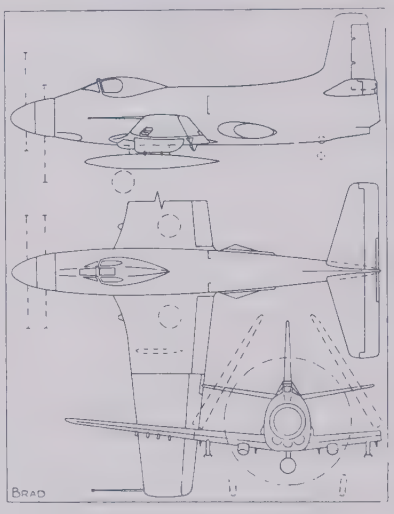
The Douglas XA2D-1 Skyshark (Allison T40 turboprop engine).

components of the T40 engine may be cut out to obtain greater flight endurance. The main fuel tank is located behind the pilot's cockpit and above the engine compartment, from which it is isolated by a fireproof bulkhead provided with overboard drains to prevent the possibility of fuel leaking on to the engine.

The cockpit is forward of the wing leading-edge and because of the location of the engine an upward ejection seat is fitted instead of the underside bail-out chute as used in the F3D and A3D.

As the high speed of the A2D is greater than the greatest speed of the standard 2,000-lb. bomb, it has been necessary to develop a new streamline bomb casing. With three of the new streamlined 2,000-lb. bombs the A2D is 50 knots faster than with three of the standard shape bombs. As new low-drag bombs are not yet available, alternate provisions are made for carrying the standard bombs. Other stores which may be carried externally include three "Tiny Tim" rockets, torpedoes, or 150 or 300 U.S. gallon fuel tanks. In addition, eight 5-in. rockets may be carried under the outer wings.

The first prototype XA2D-1 made its maiden flight at the Edwards AFB, Muroc, California, on June 1, 1950. Ten A2D-1's are being built for service trials.



The Douglas XA2D-1 Skyshark.

THE DOUGLAS SKYRAIDER.
U.S. Navy designation : AD.

The Skyraider was the third design conceived by the Douglas company to replace the SBD dive-bomber. Under the original designation XBT2D-1, the design was submitted to the U.S. Navy in July, 1944, and the prototype first flew in the following April. It went into production under the simplified Naval Attack designation AD. Since then the aircraft has undergone considerable development, resulting in the AD-2, AD-3, AD-4, AD-5 and AD-6.

The Skyraider is still in production and is still the standard carrier-borne Attack aircraft in the U.S. Navy. The following are the principal versions :—

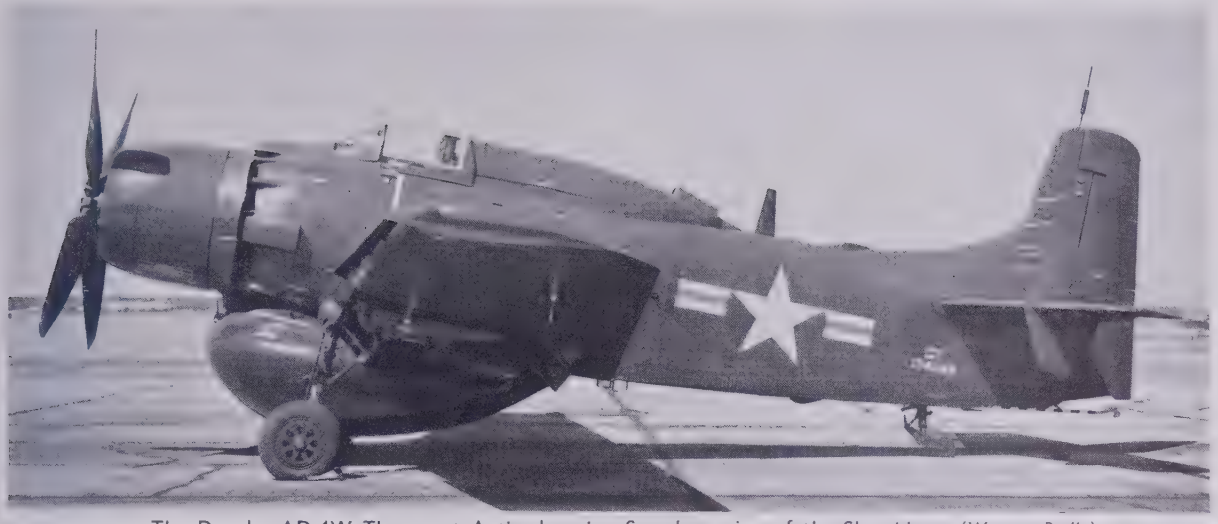
AD-1. 2,400 h.p. Wright R-3350-24 engine. First production series. Subtypes include (*a*) AD-1Q radar countermeasure aircraft with additional radar operator ; (*b*) AD-1W special search and early-warning radar aircraft with two additional radar operators ; and AD-1N night attack aircraft with two additional radar operators. All additional crews carried in rear fuselage.

AD-2. 2,700 h.p. Wright R-3350-26W engine. Increased performance and many internal refinements to give simplified control, improved vision, etc. AD-2Q (and AD-2Q (V) target tug), AD-2W and AD-2N tactical versions (see functions under AD-1).

AD-3. 2,700 h.p. Wright R-3350-26W engine. Strengthened landing-gear and longer-stroke oleo legs, improved canopy,



A Douglas AD-4B before taking-off with a gross load, including ammunition and fuel, of 14,941 lb. (6,783 kg.).
(Carl Stanke).



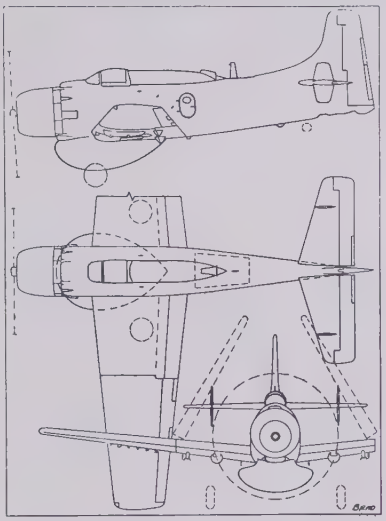
The Douglas AD-4W Three-seat Anti-submarine Search version of the Skyraider. (*Warren Bodie*).

etc., AD-3Q, AD-3W, AD-3N, AD-3S (anti-submarine) and AD-3E (special electronic equipment) versions.

AD-4. Development of AD-3. Redesigned cockpit, auto-pilot fitted, improved radar, etc. AD-4B modified to carry "special weapons" into production in 1952. Also AD-4Q, AD-4W and AD-4N special multi-seat tactical models. AD-4W in service with Royal Navy.

AD-5. "Multiplex" version permitting basic single-seat aircraft to be converted with standard kits to any one of twelve or more combat or tactical versions, including day or night attack, photographic reconnaissance, target-tug, -Q, -N, -W, and -S special radar-equipped multi-seaters, passenger-carrying (eight persons) and ambulance (four stretchers) versions. Redesigned fuselage with new wider cockpit to permit side-by-side seating, direct communication between crew members and complete interchangeability of stations, larger vertical tail surfaces, etc.

AD-6. Improved AD-4 with special equipment for ground support. Into production in 1952.



The Douglas AD-4W Skyraider.

The following description refers to the AD-4 :—

Type.—Single-seat Naval Attack monoplane.

Wings.—Low-wing cantilever monoplane. All-metal structure in three-main sections, comprising a centre-section and two upward-folding outer sections. Hydraulic folding controlled from cockpit. Gross wing area 400.33 sq. ft. (37.19 m.²). All-metal ailerons on outer sections with trim and balance tabs in each. Hydraulically operated Fowler-type trailing-edge landing flaps on centre-section.

Fuselage.—All-metal monocoque structure with integral fin. The dive-brakes are components of the fuselage and consist of three rectangular surfaces, one on each lower side of the fuselage and one below, hinged at their forward ends in line with the trailing-edge of the wings. These surfaces are extended hydraulically outwards and downwards into the airstream.

Tail Unit.—Cantilever monoplane type. All-metal structure including covering of movable surfaces. Electrically-controlled adjustable tailplane. Aerodynamically and statically balanced rudder and elevators. Trim and balance tabs in rudder.

Landing Gear.—Retractable two-wheel type. Main wheels on single compression legs are raised backwards and turn through



The Douglas AD-5 All-purpose version of the Skyraider (2,700 h.p. Wright R-3350 engine).

90 degrees while retracting to lie flat within wing. Hydraulic actuation. Forwardly-retracting tail-wheel. Deck arrester hook aft of tail wheel.

POWER PLANT.—One 2,700 h.p. Wright R-3350-26W eighteen-cylinder two-row radial air-cooled engine. Engine mounted at 4½° downthrust. Aeroproducts four-blade constant-speed airscrew 13 ft. 6 in. (4.11 m.) diameter. Single leakproof fuel cell occupies the entire fuselage bay aft of the pilot's cockpit. Long-range fuel tanks may be carried on the wing bomb shackles.

ACCOMMODATION. — Pilot's cockpit with blister-type blown canopy over fore part of wing with downward vision angle of 15 degrees. Full naval radio and radar equipment.

ARMAMENT.—Two 20 mm. cannon, one in each extremity of the centre-section inboard of the wing-fold hinges. Launchers for twelve 5 in. (12.7 cm.) zero-length and two 12 in. (30.5 cm.) "Tiny Tim" rocket projectiles under wings. Torpedo carried externally in crutches under the fuselage Bomb racks under the fuselage and each outer wing. Bomb load (normal) 4,000 lb. (1,816 kg.), (max.) 6,000 lb. (2,722 kg.).

DIMENSIONS.—Span 50 ft. $0\frac{3}{8}$ in. (15.24 m.).
Width folded 24 ft. (7.32 m.).
Length 39 ft. $3\frac{3}{4}$ in. (12 m.).
Height (over airscrew) 15 ft. 10 in. (4.82 m.).

WEIGHTS.—
Weight empty 10,550 lb. (4,790 kg.).
Normal loaded weight 16,500 lb. (7,490 kg.).
Max. overload weight 18,500 lb. (8,400 kg.).

PERFORMANCE.—
Max. speed 365 m.p.h. (584 km.h.) at 15,000 ft. (4,575 m.).
Initial rate of climb 2,850 ft./min. (870 m./min.).
Service ceiling over 25,000 ft. (7,620 m.).
Max. combat radius 1,500 miles (2,412 km.).

THE DOUGLAS DC-8.

The designation DC-8 has been assigned to a design for a four-jet transport which is under development. The DC-8 will be powered by four Pratt & Whitney J57 turbojet engines which will be mounted in pods beneath the swept-back wing leading-edges. Intended for both domestic and international use, the DC-8 will have accommodation for up to 80 passengers and will have a cruising speed of over 500 m.p.h. (800 km.h.). The prototype is not likely to be flying before 1955.

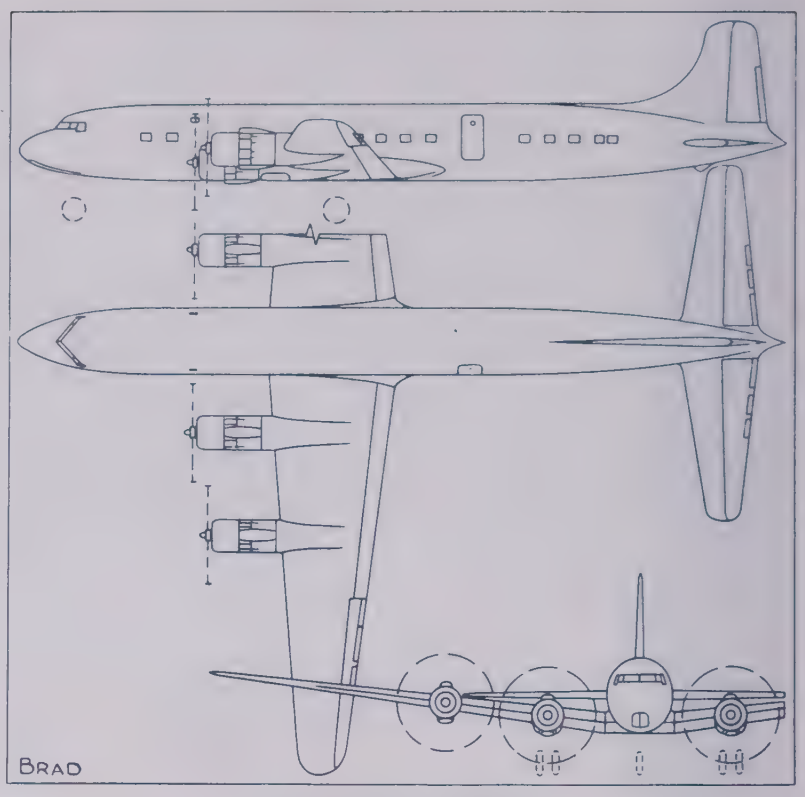
THE DOUGLAS DC-7.

The DC-7 is an evolutionary development of the DC-6 from which it differs mainly by having an 8 foot (2.44 m.) longer fuselage and a power-plant consisting of four 3,250 h.p. Wright Turbo-Cyclone compounded engines.

By the beginning of 1953 fifty-eight DC-7's had been ordered; twenty-five each by American Air Lines and United Airlines, and four each by Delta Air Lines and National Air Lines.

TYPE.—Four-engined Airliner.

WINGS.— Low-wing cantilever monoplane. All-metal structure. Same as for DC-6.



The Douglas DC-7 Airliner.

Gross wing area 1,463 sq. ft. (136 m.²).

FUSELAGE. — All-metal semi-monocoque structure as for DC-6.

TAIL UNIT.—Cantilever monoplane type. Same structure and areas as for DC-6.

LANDING GEAR.—Retractable tricycle type. Same as for DC-6 except wheelbase 36 ft. 2 in. (11 m.).

POWER PLANT.—Four 3,250 h.p. (T.O.) Wright R-3350-18DA1 Turbo-Cyclone eighteen-cylinder radial air-cooled compounded engines, each driving a four-blade Hamilton Standard high activity airscrew 13 ft. 6 in. (4.1 m.) diameter. Fuel in eight wing tanks. Fuel capacity 5,512 U.S. gallons (domestic), 6,250 U.S. gallons (oversea).

ACCOMMODATION.—Similar to DC-6. Crew of three (domestic) or five (oversea) plus cabin attendants. Accommodation for 60 passengers, plus six lounge seats in de-luxe version, or up to 95 in coach version. Automatically controlled air-conditioning and pressurisation to provide S/L atmosphere at 12,500 ft. (3,810 m.) equivalent of 5,000 ft. (1,525 m.) at 20,000 ft. (6,100 m.) and equivalent of 8,000 ft. (2,440 m.) at 25,000 ft. (7,625 m.). All freight and baggage space below cabin floor. Total cargo capacity 743 cub. ft. (21.0 m.³) or 14,200 lb. (6,441 kg.) for domestic version; 631 cub. ft. (17.9 m.³) or 13,080 lb. (5,933 kg.) for overwater version.

DIMENSIONS.—
Span 117 ft. 6 in. (35.81 m.).
Length 108 ft. 11 in. (33.24 m.).
Height 28 ft. 7 in. (8.72 m.).

WEIGHTS (Designed).—
Domestic version.
Weight empty 66,306 lb. (30,076 kg.).
Payload (standard seating) 20,600 lb. (9,344 kg.).
Max. T.O. weight 122,200 lb. (55,429 kg.).
Max. landing weight 97,000 lb. (43,998 kg.).
Overwater version.
Weight empty 67,995 lb. (30,842 kg.).
Payload (standard seating) 22,650 lb. (10,274 kg.).
Max. T.O. weight 122,200 lb. (55,429 kg.).
Max. landing weight 102,000 lb. (46,266 kg.).

PERFORMANCE (Estimated).—
At 97,000 lb. = 43,998 kg. A.U.W.
Max. speed 409 m.p.h. (658 km.h.) at 22,200 ft. (6,767 m.).
Max. cruising speed 367 m.p.h. (591 km.h.) at 24,400 ft. (7,437 m.).
Stalling speed 100 m.p.h. (160 km.h.).
Rate of climb at S.L. 1,760 ft./min. (536 m./min.).
Rate of climb at 20,000 ft. (6,100 m.) 990 ft./min. (302 m. min.).



The Douglas DC-7 Airliner (four Wright Turbo-Cyclone compounded engines).



The Douglas DC-6 Airliner (four 2,100 h.p. Pratt & Whitney R-2800 CA15 engines).

Service ceiling 27,900 ft. (8,504 m.).
Ceiling on three engines 23,900 ft. (7,285 m.).
At 102,000 *lb.* = 46,266 *kg. A.U.W.*
Max. speed 406 m.p.h. (653 km.h.) at 22,100 ft. (6,736 m.).
Max. cruising speed 360 m.p.h. (579 km.h.) at 24,300 ft. (7,406 m.).
Stalling speed 102.4 m.p.h. (164.8 km.h.).
Rate of climb at S.L. 1,620 ft./min. (494 m./min.).
Rate of climb at 20,000 ft. (6,100 m.) 870 ft./min. (265 m./min.).
Service ceiling 27,100 ft. (8,260 m.).
Ceiling on three engines 22,900 ft. (6,980 m.).
At 110,000 *lb.* = 49,895 *kg. A.U.W.*
Max. speed 401 m.p.h. (645 km.h.) at 22,000 ft. (6,706 m.).
Max. cruising speed 349 m.p.h. (562 km.h.) at 24,000 ft. (7,315 m.).
Stalling speed 106.3 m.p.h. (171 km.h.).
Rate of climb at S.L. 1,520 ft./min. (463 m./min.).
Rate of climb at 20,000 ft. (6,100 m.) 690 ft./min. (210 m./min.).
Service ceiling 25,900 ft. (7,894 m.).
Ceiling on three engines 21,400 ft. (6,523 m.).

RANGES.—
At 15,000 *ft.* = 4,575 *m.*
With 5,512 U.S. gallons (20,865 litres) fuel 4,430 miles (7,130 km.).
With 6,250 U.S. gallons (23,658 litres) fuel 5,130 miles (8,255 km.).
At 23,500 *ft.* = 7,163 m.
With 5,512 U.S. gallons (20,865 litres) fuel 3,905 miles (6,285 km.).
With 6,250 U.S. gallons (23,658 litres) fuel 4,455 miles (7,170 km.).
RANGES (at 20,000 ft. = 6,100 m.).—
With 4,512 U.S. gallons (17,055 litres) 3,500 miles (5,600 km.).
With 6,600 U.S. gallons (24,950 litres) 5,175 miles (8,280 km.).

THE DOUGLAS DC-6.
U.S. Air Force designation : C-118.

The DC-6 is a larger and more powerful development of, and successor to, the DC-4. Compared with the DC-4 it has a longer fuselage and a more powerful engine installation and included among its features are pressurised cabins for crew and passengers; roomier cabin, seats and berths; reversible-pitch airscrews and thermal de-icing for wings, tail and wind-shield. 175 DC-6's had been delivered to U.S. domestic and foreign airlines by the end of 1951 and the type is still in production, mainly in the DC-6A and DC-6B versions (which see).

The former Presidential transport *Independence*, which is the only DC-6 to carry a military designation (C-118) is now the personal transport of the Chief of Staff, U.S. Air Force.

TYPE.—Four-engined Airliner.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23016-23012. Incidence at root 4°. Dihedral 7°. All-metal structure with smooth Alclad skin. NACA slotted flaps inboard of ailerons. Thermal de-icing.

FUSELAGE.—Semi-monocoque all-metal structure with flush-riveted Alclad skin.

TAIL UNIT.—Cantilever monoplane type. Fin area 93.4 sq. ft. (8.67 m.²), Rudder area (aft of hinge, with tab) 49 sq. ft. (4.55 m.²), Total vertical area 159.9 sq. ft. (14.86 m.²), Tailplane area 210.9 sq. ft. (19.59 m.²), Elevator area (aft of hinge, with tab) 108.9 sq. ft. (10.11 m.²).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction with emergency manual gear. Hydraulic wheel brakes. Steerable nose wheel. Track 24 ft. 8 in. (7.52 m.). Wheel base 30 ft. 8 in. (9.34 m.).

POWER PLANT.—Four Pratt & Whitney Double-Wasp R-2800-CA15 eighteen-cylinder two-row radial air-cooled engines, each normally rated at 1,800 h.p. at 6,000 ft. (1,830 m.), 1,600 h.p. at 16,000 ft. (4,880 m.) and with a take-off output of 2,100 h.p. without or 2,400 h.p. with water injection. Hamilton Standard three-blade constant-speed full-feathering and reversible airscrews 13 ft. 1 in. (3.98 m.) diameter. Fuel capacity from 3,322 to 4,700 U.S. gallons (12,560 to 17,770 litres).

ACCOMMODATION.—Pressurised accommodation for crew and passengers. Passenger compartment seats 48 by day and for short-range can accommodate up to a maximum of 58. Entrance vestibule with coat-room and galley aft of wings with cabin space fore and aft. Upper and lower



The Douglas DC-6A Freighter (four 2,500 h.p. Pratt & Whitney R-2800-CB17 engines).



The Douglas C-118A, the U.S.A.F. transport version of the DC-6A.

berths of 26 to 39 passengers may be fitted up in 30 seconds. Upper berths have separate air-conditioning controls. All berths have reading lights and storage space for clothing and toilet accessories. Men's lounge and toilet forward of main cabin, ladies' lounge, etc. aft of main cabin. Entire cabin space has fibre-glass sound-proofing and floors covered with foam-rubber-backed carpets. Pressurisation ensures cabin pressure altitude of approximately 5,000 ft. (1,525 m.) when flying at 16,000 ft. (4,880 m.), or 8,000 ft. (2,440 m.) when flying at 20,000 ft. (6,100 m.). Passenger cabin dimensions 64 ft. (19.5 m.) long 7 ft. 3 in. (2.2 m.) high. All freight and baggage space below cabin floor with new handling facilities to permit quick loading and unloading.

DIMENSIONS.—
Span 117 ft. 6 in. (35.81 m.).
Length 100 ft. 7 in. (30.66 m.).
Height (overall) 28 ft. 5 in. (8.66 m.).

WEIGHTS AND LOADINGS.—
Weight empty 51,495 lb. (23,380 kg.).
Weight loaded 97,200 lb. (44,130 kg.).
Wing loading 66.4 lb./sq. ft. (324 kg./m.²).
Power loading 10.1 lb./h.p. (4.58 kg./h.p.).

PERFORMANCE.—
Max. speed 356 m.p.h. (570 km.h.) at 19,600 ft. (5,980 m.).
Cruising speed 313 m.p.h. (501 km.h.) at 20,400 ft. (6,220 m.).
Landing speed 91 m.p.h. (145.6 km.h.).
Rate of climb at S/L. 1,070 ft./min. (326 m./min.).
Rate of climb at S/L. (one engine inoperative) 560 ft./min. (171 m./min.).
Normal range 3,820 miles (6,112 km.).
Max. range 4,610 miles (7,376 km.).
Take-off distance to 50 ft. (15.25 m.) S/L. (no wind) 1,240 yds. (1,133 m.).
Landing distance from 50 ft. (15.25 m.) 2,860 ft. (872 m.).
Landing distance from 50 ft. (15.25 m.) with reversible airscrews 2,150 ft. (656 m.).

THE DOUGLAS DC-6A.
U.S. Air Force designation: C-118A.
U.S. Navy designation: R6D-1.

The DC-6A is a freight-carrying version of the standard DC-6. It uses the wings, tail-unit and landing-gear of the DC-6 but has an entirely new fuselage incorporating features which experience has shown to be necessary for successful military and commercial cargo operation.

The new fuselage is 5 ft. (1.525 m.) longer than that of the DC-6, giving the DC-6A a total cargo space of 5,000 cub. ft. (141.5 m.³). The main cabin of constant cross-section throughout, is 68 ft. (20.74 m.) long, 7 ft. 9 in. (2.36 m.) high, and 8 ft. 9 in. (2.67 m.) wide at floor level. Two large doors, one forward and the other aft of the wings, are hinged at their top edges and swing upward to be clear of loading equipment. A self-powered loading elevator, which folds up for storage within the aircraft, can be attached to either front or rear cargo door and will lift 4,000 lb. (1,820 kg.) from truck-bed height to cabin floor level.

The DC-6A has automatically controlled cabin pressurisation and air-conditioning systems to permit high-altitude transportation of perishable cargoes.

Military DC-6A's under the designation R6D-1 are in production for the U.S. Navy and as C-118A's for the U.S.A.F. The military versions, although primarily cargo transports, may be rapidly converted for passenger or troop carrying or air evacuation. In these forms they have accommodation for 60 passengers in rearward-facing seats, 76 on troop benches, or 40 stretcher cases.

POWER PLANT.—Four Pratt & Whitney Double-Wasp R-2800-CB17 eighteen-cylinder radial air-cooled engines each developing 1,900 h.p. at max. continuous cruise and with 2,500 h.p. available for take-off with alcohol-water injection. Hamilton Standard or Curtiss Electric full-feathering and reversible airscrews. Standard fuel capacity 3,992 U.S. gallons (15,111 litres), with optional capacities of 5,406 U.S. gallons (20,550 litres) and 5,512 U.S. gallons (20,918 litres).

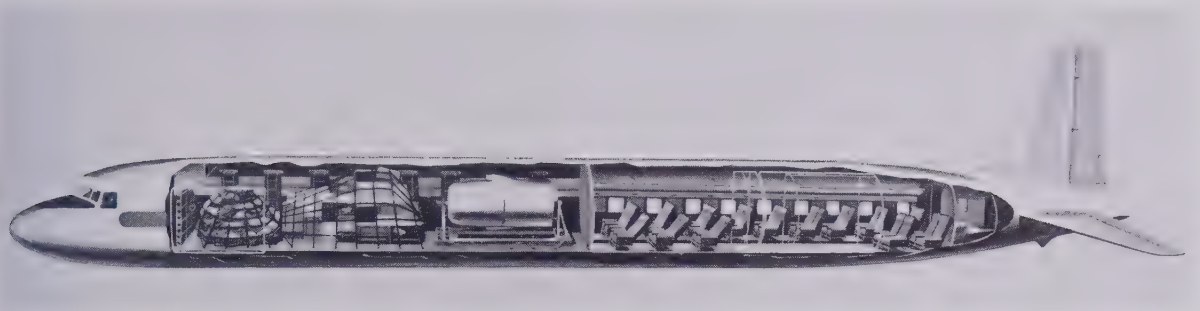
DIMENSIONS.—
As for DC-6 except Length 105 ft. 7 in. (32.20 m.).

WEIGHTS AND LOADINGS.—
Weight empty 49,767 lb. (22,595 kg.).
Gross T.O. weight 106,000 lb. (48,125 kg.).
Wing loading 72.5 lb./sq. ft. (353.8 kg./m.²).
Power loading 10.6 lb./h.p. (4.81 kg./h.p.).

PERFORMANCE.—(At 95,000 lb. = 42,800 kg. gross weight).—
Max. speed 360 m.p.h. (576 km.h.) at 18,100 ft. (5,520 m.).
Cruising speed 307 m.p.h. (494 km.h.) at 22,400 ft. (7,390 m.).
Landing speed 93 m.p.h. (149 km.h.).
Initial rate of climb 1,120 ft./min. (374 m./min.).
Initial rate of climb (one engine out) 620 ft./min. (203 m. min.).
T.O. distance to 50 ft. (15.25 m.) at max. A.U.W. (no wind) 4,500 ft. (1,492 m.).
Landing distance from 50 ft. (15.25 m.) 3,010 ft. (918 m.).
Landing distance from 50 ft. (15.25 m.) with reversible airscrews 2,250 ft. (686 m.).
Normal range 3,860 miles (6,176 km.).
Max. range 4,910 miles (7,856 km.).



The Douglas DC-6B Airliner (four 2,500 h.p. Pratt & Whitney R-2800-CB16 engines).



A drawing of a typical interior arrangement of the DC-6C.

THE DOUGLAS DC-6B.

The DC-6B is a passenger version of the DC-6A. The larger fuselage offers approximately 7% greater payload capacity and 14% greater passenger capacity than the standard DC-6, with only 4% greater operating costs.

The standard domestic dayplane version of the DC-6B carries 64 passengers, eight more than the standard DC-6, while a trans-oceanic model with larger galleys, coatrooms and toilet compartments carries 54 passengers instead of the present DC-6 limit of 48. A high-density 92-passenger version with an air-coach type interior is also available.

DC-6B's have been bought by United Airlines, National Airlines, Pan American World Airways, Panagra, American Airlines, Scandinavian Airlines System, Swissair, K.L.M., Western Air Lines, Sabena, Cie. de Transports Aériens Intercontinentaux (T.A.I.), Cia. Mexicana de Aviacion, Canadian Pacific Airlines, etc.

The DC-6B is available with either the Pratt & Whitney R-2800-CB17 or R-2800-CB16 power-plants. With the CB17 power-plant the maximum take-off weight is 106,000 lb. (48,125 kg.) and the performance is the same as for the DC-6A. With the CB16 power-plant which has 2,400 h.p. available for take-off, the maximum take-off weight is 100,000 lb. (45,400 kg.) and the corresponding take-off distance over a 50 ft. (15.25 m.) obstacle with no wind is 3,780 ft. (1,153 m.). The cruising and landing performance are the same as for the DC-6A. The empty weight of the standard DC-6B is 54,148 lb. (24,583 kg.) and the maximum landing weight is 88,200 lb. (40,043 kg.).

The version of the DC-6B supplied to Pan American World Airways has been specially modified for use on that operator's tourist class services. Pan American has acquired a fleet of forty-five aircraft of this type, which it calls the Super 6.

The Super 6, which has been certificated for a gross take-off weight of 107,000 lb. (48,580 kg.), carries a greater payload, has an increased fuel capacity and an improved performance. It has a standard accommodation for 82 passengers for trans-Atlantic tourist class operations.

THE DOUGLAS DC-6C.

The DC-6C, the latest addition to the DC-6 series of transports, is a convertible aircraft which combines the special cargo facilities of the DC-6A with the passenger comfort features of the DC-6B. It can accommodate up to a maximum of 76 passengers, and may be converted to carry a mixed passenger/cargo load or be stripped down as a pure cargo aircraft to carry nearly 13 tons.

A feature of the DC-6C is a movable bulkhead which can be positioned at four different stations so that the interior arrangement can be adjusted to suit varying passenger and cargo requirements to meet current needs.

The cabin is equipped with lightweight seats which fold up against the walls when cargo space is needed in any or all of four cabin sections. Tourist or coach-type buffet facilities for serving food and refreshments may be removed when no passengers are carried. DC-6A type freight-loading doors fore and aft are standard, as are the cabin pressurisation and air-conditioning systems.

The power-plant consists of four Pratt & Whitney R-2800 engines of the CB Series and all structural and dimensional data are the same as for the DC-6A and DC-6B.

ERCOUPE

ENGINEERING & RESEARCH CORPORATION.

HEAD OFFICE AND WORKS: RIVERDALE, MARYLAND.

Chairman of the Board of Directors: H. A. Berliner.

President: L. A. Wells.

The Engineering and Research Corporation was established in 1930, and manufactures various types of machinery used in aircraft and airscrew production. It has recently begun the manufacture of controllable-pitch airscrews and also undertakes the design and manufacture of light aircraft.

The first aircraft produced by the Company was designed by Mr. Weick and is a two-seat all-metal low-wing cantilever monoplane incorporating a control system which eliminates the necessity for rudder pedals, the aeroplane being flown entirely by the control wheel. This aeroplane, known as the Ercoupe Model 415C, was introduced on the market in 1940, but production ceased on America's entry into the War, during which the Company was fully engaged in defence contracts.

Production of the Ercoupe was resumed after the war, but it was again discontinued in 1951, when the company was obliged to devote its entire activities to the defense programme.

Full descriptions of the post-war models of the Ercoupe have been published in previous issues.

The World-wide Sales rights for the Ercoupe are held by the Sanders Aviation Company, of Riverdale, Md.

FAIRCHILD

THE FAIRCHILD ENGINE AND AIRPLANE CORPORATION.

EXECUTIVE OFFICE: HAGERSTOWN, MARYLAND.

Chairman of the Board: James A. Allis.

President: Richard S. Boutelle.

Vice-President and General Manager, Engine Division: George F. Chapline.

Vice-President and General Manager, Aircraft Division: Willard L. Landers.

Executive Vice-President, Comptroller: A. F. Flood.

Vice-Presidents: Paul J. Frizzell and F. E. Mewbold, Jr.

Secretary: Paul S. Cleaveland.

Treasurer: Floyd S. Bennett, Jr.

FAIRCHILD AIRCRAFT DIVISION

Divisional Office and Works: Hagerstown, Maryland.

General Manager: Willard L. Landers.

Manager of Engineering: Louis Fahnestock.

Chief of Design Engineering: Walter Tydon.

FAIRCHILD ENGINE DIVISION

Divisional Office and Works: Farmingdale, Long Island, N.Y.

General Manager: George F. Chapline.

Assistant General Manager: Evard M. Lester.

Chief Engineer: Alfred T. Gregory.

GUIDED MISSILES DIVISION

Divisional Office and Works: Wyandanch, Long Island, N.Y.

General Manager: Edwin A. Speakman.

STRATOS DIVISION

Divisional Office and Works: Bay Shore, Long Island, N.Y.

General Manager: F. E. Newbold, Jr.

The Fairchild Engine and Airplane Corporation was formed in 1936 to acquire from the Fairchild Aviation Corporation its aeroplane and aero-engine manufacturing subsidiaries.

The Fairchild Aircraft Division is engaged in the production of the Fairchild C-119 Packet for the U.S. Air Force. The C-82 and C-119 are both used by the Tactical Air Command of the U.S.A.F. as transports for troops and cargo. They are also used for training paratroops, airlift operations and air rescue work. This division also built the XC-120 Packplane, with detachable cargo compartment, for the Air Force under a developmental contract. The XC-120 has been illustrated and described in previous editions of this Annual.

The Fairchild Engine Division is engaged in research and development work for the U.S. Navy and Air Force. Several unique types of power-plant, most of them classified, are either in the production or in the experimental development stage.

The Guided Missiles Division is developing and producing guided missiles and missile guidance and launching systems for the Bureau of Aeronautics of the U.S. Navy. It also is producing missiles for the U.S. Air Force and U.S. Army.

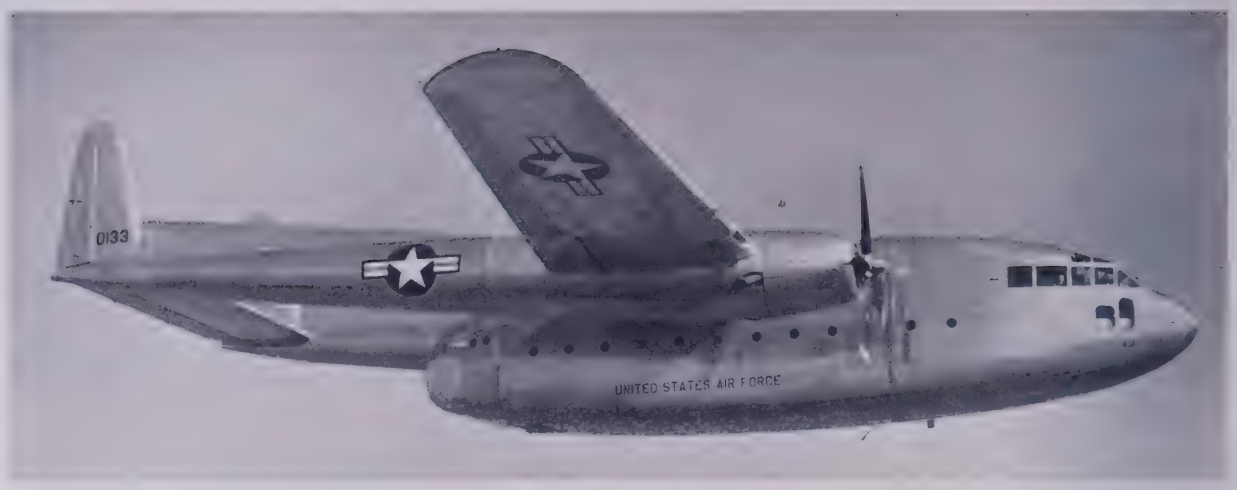
The Stratos Division specializes in the design and production of pressurization and cooling equipment for aircraft. The division is producing in volume compact air cycle refrigeration units for use in high-speed jet aircraft.

In 1952 the Fairchild Engine and Airplane Corporation acquired an option on licences to build the Fokker S.11, S.12, S.13, S.14 and S.27 from the N.V. Koninklijke Nederlandsche Vliegtuigen-Fabriek Fokker.

THE FAIRCHILD PACKET.

U.S. Air Force designations: C-82 and C-110.
U.S. Navy Designation: R4Q.

The original design of the Packet was



The Fairchild C-119C Packet (two 3,500 h.p. Pratt & Whitney R-4360 engines).

begun in 1941 and the design and mock-up were approved by the U.S. Army in 1942. The actual detailed development and engineering, including the construction and preliminary testing of the prototype XC-82, which first flew on September 10, 1944, took less than 21 months.

The C-82 was put into production before the end of the war and a total of 220 aircraft of this type had been built by Fairchild by September, 1948, when production on this model ceased.

Late in 1947 a new and improved version of the C-82 made its first flight. This version, designated C-119, has been the subject of considerable development and is still in production. The principal change was the re-location of the flight deck from the former position on the top of the fuselage to the nose to give improved vision ahead and below for formation flying during troop and supply dropping. The fuselage is 14 in. (35.6 cm.) wider and wings of greater strength permit an increase in the maximum permissible gross weight to 74,000 lb. (33,600 kg.). The capacity of the freight hold has been increased to 2,700 cub. ft. (76 m.³).

The following are the announced versions of the Packet :—

C-82A. Two 2,100 h.p. Pratt & Whitney R-2800-85 engines. Production model of the XC-82. Out of production in September, 1948.

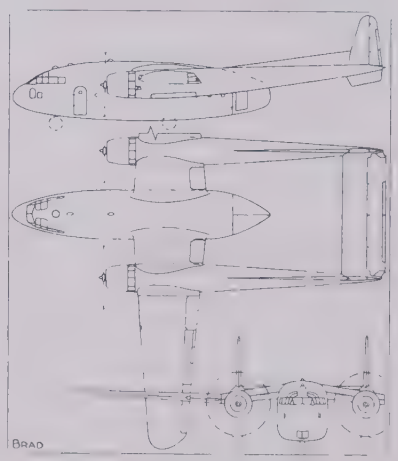
C-119A. Prototype modified from standard C-82A to test the new nose configuration and new power-plant.

C-119B. Two Pratt & Whitney R-4360-20 twenty-four cylinder radial engines with two-stage blowers, rated at 2,650 h.p. to 6,000 ft. (1,830 m.), 2,300 h.p. at 18,000 ft. (5,480 m.) and with 3,250 h.p. available for take-off. Production version of C-119A.

C-119C. Two Pratt & Whitney R-4360-20W engines developing 3,500 h.p. for take-off. Dorsal fins added to booms.

R4Q-1. U.S. Marine Corps version of C-119C. The two versions are identical.

C-119F. Similar to C-119C but fitted with two 3,350 h.p. Wright R-3350-85 engines and Hamilton Standard airscrews. Small ventral fins added.



The Fairchild C-119F Packet.

R4Q-2. U.S. Marine Corps version of C-119F.

C-119G. As C-119F but with Aero-Products airscrews. In production.

C-119H. Extensively re-designed Packet with new wings of increased span and 40 per cent. greater area, new tail with square-tipped extensions outboard of booms, new landing-gear, a new power-plant comprising two Wright R-3350-85 Turbo Cyclone engines, and all fuel carried in large external underwing tanks. Cargo capacity increased to 27,200 lb. (12,350 kg.). First flew on May 27, 1952. At time of writing, prototype was undergoing service trials.

TYPE.—Twin-engined Cargo and Troop Transport.

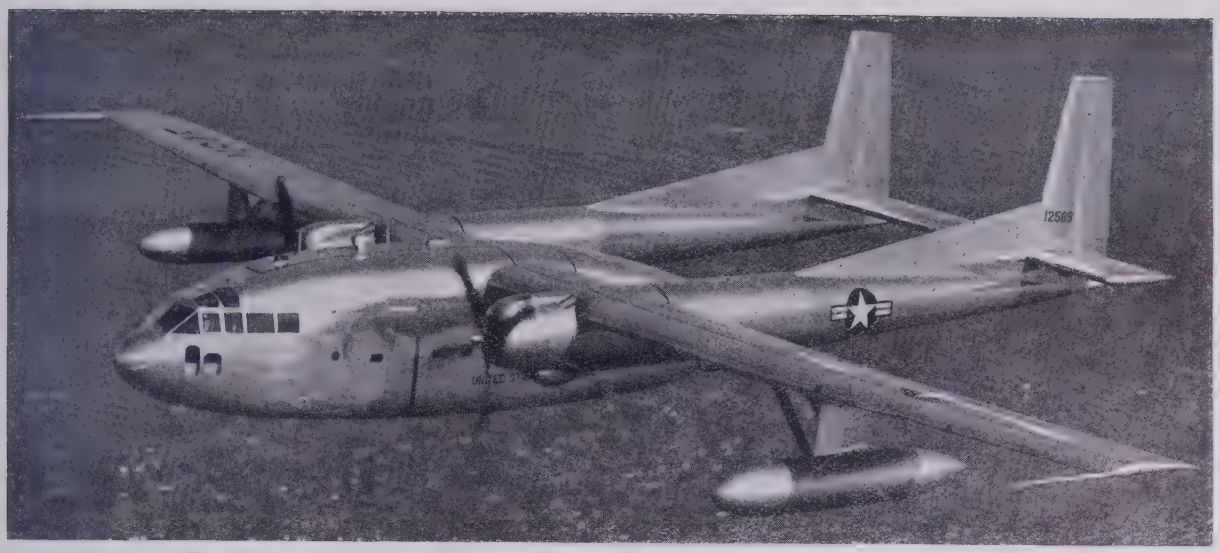
WINGS.—Cantilever high-wing monoplane. Two-spar all-metal structure in three main sections consisting of anhedral centre-section set into fuselage and carrying engine nacelles and tail booms and two outer wings. Detachable tips. Metal ailerons on outer wings. Thermal de-icing. Total area of ailerons 112 sq. ft. (10.4 m.²). Total area of flaps 100 sq. ft. (9.3 m.²). Gross wing area 1,447 sq. ft. (134.4 m.²).

FUSELAGE.—All-metal semi-monocoque structure. Structure consists of Alclad vertical frames, longitudinal stringers and longitudinal and transverse beams, with Alclad skin. Seven longitudinal beams take the floor and tie-down loads beneath a ply-covered floor.

TAIL BOOMS.—All-metal structures. Each in two main sections. Forward section bolted to engine nacelle structure aft of trailing edge. Aft section is bolted to forward section at leading-edge of tailplane.



The Fairchild C-119F Packet (two 3,350 h.p. Wright R-3350 engines).



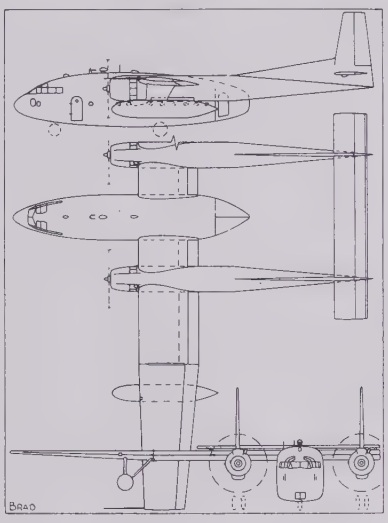
The Fairchild C-119H Packet (two 3,350 h.p. Wright R-3350 Turbo-Cyclone engines).

TAIL UNIT.—Cantilever monoplane type with twin fin and rudders. All-metal structures. Tailplane and fins have stressed metal skin covering; one-piece metal framed elevator and rudders have metal noses and fabric covering over all. Controllable trim-tabs in elevator and rudders, latter also having spring-loaded tabs. Thermal de-icing for all fixed tail surfaces. Areas: vertical fins without dorsal and ventral additions 87.4 sq. ft. (8.12 m.²), rudders 42.4 sq. ft. (3.94 m.²), tailplane 232.4 sq. ft. (21.6 m.²), elevators 113.8 sq. ft. (10.6 m.²).

LANDING GEAR.—Retractable tricycle type. Electrical actuation. In emergency, the clutch at the electric actuators is released to allow the gears to "free fall" into the down position. Hydraulic brakes on main wheels.

POWER PLANT.—Two 3,500 h.p. Pratt & Whitney R-4360-20W (C-119C) or Wright R-3350-85 (C-119F, C-119G and C-119H) radial air-cooled engines. Hamilton Standard Hydromatic (C-119C, C-119F and C-119G) or Aero-Products (C-119G) four-blade constant-speed and reversing airscrews. Total fuel capacity 2,624 U.S. gallons (9,920 litres).

ACCOMMODATION.—Flight deck has two seats side-by-side for pilot (on port) and co-pilot; navigator's seat and table are on starboard side of the aircraft; the radio operator is centrally located behind the pilot and co-pilot. A crew chief's seat is provided behind the pilot over the entrance hatch. Individual oxygen equipment for all members of crew. Access to the flight deck is by a ladder on the port side. The aircraft is equipped as a troop transport, ambulance or medium cargo transport. An electrically-operated monorail discharges paracans through a hatch in the bottom of the fuselage. Ramps provided to load wheeled or tracked equipment. Heavy reinforced floors are at truck bed level. Rear cargo doors open on vertical hinge line providing entrance opening as wide and high as cargo hold. Small door in each main cargo door for simultaneous jumping of two sticks of paratroopers. Interior dimensions of cabin or hold: Length 36 ft. 11 in. (11.25 m.). Width 9 ft. 10 in. (3.0 m.). Height 8 ft. (2.44 m.). Floor area 353 sq. ft. (32.8 m.²). Volume 3,150 cub. ft. (88.2 m.³). Normal seating capacity 67. Maximum seating capacity (emergency evacuation) 78. Stretcher patients 35. Monorail capacity 20 bundles each weighing 500 lb. (227 kg.). Glider tow capacity one 30,000 lb. (13,620 kg.) glider.



The Fairchild C-119H Packet.

DIMENSIONS.—
Span 109 ft. 3 in. (33.32 m.).
Length 86 ft. 6 in. (26.38 m.).
Height 26 ft. 3 in. (8.0 m.).

DIMENSIONS (C-119H only).—
Span 148 ft. (44.2 m.).
Length 95 ft. 8 in. (29.16 m.).
Height 32 ft. (9.76 m.).

WEIGHTS AND LOADINGS (C-119C).—
Weight empty 39,942 lb. (18,134 kg.).
Payload 27,500 lb. (12,485 kg.).
Max. T.O. weight 73,150 lb. (33,210 kg.).
Wing loading 50.5 lb./sq. ft. (246.4 kg./m.²).
Power loading 10.5 lb./h.p. (4.76 kg./h.p.).

WEIGHTS AND LOADINGS (C-119F).—
Weight empty 39,809 lb. (18,083 kg.).
Payload 28,000 lb. (12,712 kg.).
Max. T.O. weight 72,800 lb. (33,050 kg.).
Wing loading 50.5 lb./sq. ft. (246.4 kg./m.²).
Power loading 10.5 lb./h.p. (4.76 kg./h.p.).

WEIGHTS AND LOADINGS (C-119G).—
Weight empty 39,982 lb. (18,152 kg.).
Payload 28,000 lb. (12,712 kg.).
Max. T.O. weight 74,400 lb. (33,778 kg.).
Wing loading 51.4 lb./sq. ft. (250.8 kg./m.²).
Power loading 10.6 lb./h.p. (4.81 kg./h.p.).

WEIGHTS AND LOADINGS (C-119H).—
Weight empty 46,455 lb. (21,090 kg.).
Payload 30,000 lb. (13,620 kg.).
Max. T.O. weight 85,900 lb. (39,000 kg.).
Wing loading 42.3 lb./sq. ft. (206.4 kg./m.²).
Power loading 12.3 lb./h.p. (5.58 kg./h.p.).

PERFORMANCE (C-119C—2X Pratt & Whitney R-4360-20W engines).—
Cruising speed at 70% normal rated power 200 m.p.h. (320 km.h.).
Stalling speed 108 m.p.h. (173 km.h.).
Rate of climb at S/L. 740 ft./min. (226 m./min.).
Rate of climb on one engine at S/L. 100 ft./min. (30.5 m./min.).
Range (max.) atandard fuel 1,950 miles (3,120 km.).

PERFORMANCE (C-119F—2X Wright R-3350-85 engines).—
Cruising speed at 70% normal rated power 205 m.p.h. (328 km.h.).
Stalling speed 108 m.p.h. (173 km.h.).
Rate of climb at S/L. 820 ft./min. (250 m./min.).
Rate of climb on one engine at S/L. 100 ft./min. (30.5 m./min.).
Range (max. standard fuel) 2,300 miles (3,680 km.).

PERFORMANCE (C-119G—2X Wright R-3350-85 engines).—
Cruising speed at 70% normal rated power 200 m.p.h. (320 km.h.).
Stalling speed 108 m.p.h. (173 km.h.).
Rate of climb at S/L. 750 ft./min. (230 m./min.).
Rate of climb on one engine at S/L. 100 ft./min. (30.5 m./min.).
Range (max. standard fuel) 2,280 miles (3,648 km.).

PERFORMANCE (C-119H –2X Wright R-3350-85 engines).—
Cruising speed at 70% normal rated power 190 m.p.h. (304 km.h.).
Stalling speed 92 m.p.h. (147 km.h.).
Rate of climb at S/L. 722 ft./min. (220 m./min.).
Rate of climb on one engine at S/L. 100 ft./min. (30.5 m./min.).
Range (max. standard fuel) 2,440 miles (3,905 km.).

FLETCHER

FLETCHER AVIATION CORPORATION.

HEAD OFFICE AND WORKS: 190, WEST COLORADO STREET, PASADENA, CAL.

President and Chief Engineer: Wendell S. Fletcher.

Vice-President: Lee Launer.

Secretary: Maurice C. Fletcher.

The Fletcher Aviation Corpn. entered the aircraft manufacturing field in 1941 with a two-seat primary trainer employing a plastic-plywood construction and incorporating symmetrical wings and control surfaces to provide complete interchangeability of wings, flaps, ailerons and tail-surfaces. This aircraft, the FBT-2, has been described in previous issues of this Annual.

During the war the Fletcher Aviation Corpn. was almost exclusively engaged in the manufacture of plastic plywood aircraft, components, parts and assemblies.

The Company's first post-war aircraft was the FL-23 all-metal two-seat military liaison monoplane, and this has now been followed by the FD-25, which is described and illustrated below.

A licence for the construction of the FD-25 has been acquired by the Toyo Aircraft Company of Tokyo, Japan.

Fletcher is also engaged in the design and series manufacture of jettisonable fuel napalm tanks and other aircraft components and assemblies. During 1952 over 60,000 jettisonable tanks were produced in the company's Pasadena factory.

THE FLETCHER FD-25-B DEFENDER.

TYPE.—Single-seat Light Ground Support aircraft.

WINGS.—Low-wing cantilever monoplane. Wing section. NACA 65½-415. Aspect ratio 6. Chord 5 ft. (1.52 m.). Dihedral

6° (outer wings). All-metal structure with main spar and auxilary spar for attachment of flaps and ailerons. All-metal ailerons on outer wings, interchangeable right and left. All-metal flaps. Total flap area 18 sq. ft. (1.67 m.²). Gross wing area 150 sq. ft. (13.93 m.²).

FUSELAGE.—All-metal aluminium-alloy semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal magnesium structure. Areas: fin 8 sq. ft. (0.74 m.²), rudder 4 sq. ft. (0.37 m.²), elevator 9 sq. ft. (0.84 m.²), tailplane 21 sq. ft. (1.95 m.²).

LANDING GEAR.—Fixed tail-wheel type. Cantilever oleo-pneumatic shock absorber legs. Hydraulic wheel brakes. Steel-sprung steerable tail-wheel. Track 8 ft. 1 in. (2.45 m.).

POWER PLANT.—One 225 h.p. Continental E225-8 six-cylinder horizontally-opposed air-cooled engine. McCauley BF6673 two-blade fixed-pitch airscrew. Fuel capacity 60 U.S. gallons (227 litres). Oil capacity 2.25 U.S. gallons (8.5 litres).

ACCOMMODATION.—Single-seat cockpit with sliding forward acrylate plastic canopy. Forward vision over nose 11°. Seat has adjustable back to allow for back-type parachute. Shoulder harness and inertia lock reel.

ARMAMENT. — Two-wing mounted 30-cal. machine-guns (1,000 s.p.g.). Provision for the following under-wing stores: 2×40 U.S. gallon (151 litres) Napalm bombs; 2×250 lb. (113.5 kg.) H.E. or fragmentation bombs; 32 or 40×2.75 in. rockets in clusters; or 4×5 in. rockets.

DIMENSIONS.—
Span 30 ft. (9.15 m.).
Length 20 ft. 11 in. (6.38 m.).
Height 6 ft. 3 in. (1.90 m.).

WEIGHTS.—
Weight empty 1,228 lb. (558 kg.).
Weight loaded 2,500 lb. (1,135 kg.).

PERFORMANCE.—
Max. speed at S/L. 187 m.p.h. (299 km.h.).
Cruising speed at S/L. 162 m.p.h. (259 km.h.).
Landing speed 35 m.p.h. (56 km.h.).
Initial rate of climb 1,725 ft./min. (526 m./min.).
Service ceiling 16,500 ft. (5,030 m.).
Cruising range 630 miles (1,010 km.).



The Fletcher FD-25 Defender (225 h.p. Continental E225 engine).

FUNK

FUNK AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: R.F.D. No. 5, COFFEYVILLE, KANSAS.

Sales Manager: N. F. Howard.
Chief Engineer: H. C. Funk.
Production Manager: J. C. Funk.

The Funk Aircraft Co. is the successor to Akron Aircraft, Inc., which was formed by the brothers Funk in 1939 to place on the market a light two-seat cabin monoplane known as the Model B.

After the war the company resumed production with the Funk B-85-C, which was basically the same as the pre-war Model B except that it was fitted with an 85 or 90 h.p. Continental engine in place of the 75 h.p. Lycoming and had many other refinements.

An illustrated description of the Model B-85-C has appeared in the last four editions of "All the World's Aircraft."

GOODYEAR

THE GOODYEAR AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: AKRON 15, OHIO.

President: P. W. Litchfield.
Vice-President and General Manager: T. A. Knowles.
Vice-President in charge of Engineering: Dr. Karl Arnstein.
Secretary: G. F. Clayton.

The Goodyear Aircraft Corpn. was formed on December 5, 1939, to take over from the parent Goodyear organization its principal manufacturing operations in the field of aeronautics, with the exception of tyres, inner tubes, bullet-proof fuel tanks and other rubber accessories. This also included the activities of the former Goodyear-Zeppelin Corpn., then mainly devoted to lighter-than-air craft.

The Goodyear Aircraft Corpn. continues its rôle as the sole supplier of airships to the U.S. Navy's lighter-than-air section. It has just completed its first new airship, the N-1, to be built since the war. The available details of this ship, together with information concerning other types of Goodyear airships in service with the U.S. Navy will be found elsewhere.

Goodyear undertook the manufacture of heavier-than-air-craft during the last war. Over 4,000 Corsairs to Chance Vought design were built for the U.S. Navy and a Goodyear development of the Corsair, the F2G-1, was put into production but was too late to participate in the war.

Since the war Goodyear has developed an experimental all-metal amphibian flying-boat known as the GA-22. This amphibian, fitted with an NACA planing type hull with faired step, has undergone protracted flight and water testing. A description of this amphibian has appeared in previous editions of "All the World's Aircraft."

GRUMMAN

THE GRUMMAN AIRCRAFT ENGINEERING CORPORATION.

HEAD OFFICE AND WORKS: BETHPAGE, LONG ISLAND, N.Y.

Incorporated: December 6, 1929.
Chairman of the Board: Leroy R. Grumman.
President: Leon A. Swirbul.
Executive Vice-President: William T. Schwendler.
Vice-President: E. Clinton Towl.
Secretary: Joseph A. Stamm.
Treasurer: Edmund W. Poor.

The Grumman Aircraft Engineering Corpn. continues to devote its principal activities to the construction and experimental development of aircraft for the U.S. Navy.

The latest Grumman naval fighter of which details have been released is the swept-wing F9F-6 Cougar which replaced the F9F-5 Panther in production late in 1952. A newer swept-wing carrier fighter, the XF10F-1 Jaguar, powered with a Westinghouse J40 engine, has flown in prototype form, but this design has now been abandoned. No details of the XF10F-1 have ever been released.

The AF-2 Guardian single-engined anti-submarine aircraft was phased out of production in March, 1953, and its



The Grumman F9F-6 Cougar Swept-wing Fighter. (*Harold Martin*).



The Grumman F9F-6 Cougar Naval Fighter (Pratt & Whitney J48 turbojet engine). (*Harold Martin*).

successor, the S2F-1 twin-engined Search aircraft is now in production.

The Albatross is now being built mainly in "triphibian" form for the U.S.A.F., although a few amphibians are still being delivered to the U.S. Navy and U.S. Coast Guard.

THE GRUMMAN JAGUAR.
U.S. Navy designation: XF10F-1.

The F10F-1 was designed as a supersonic carrier-based fighter and in its XF10F-1 prototype form was the first American combat type aircraft fitted with wings of variable sweepback to fly. Apart from its novel wing configuration, the aircraft incorporated a special aerodynamically-balanced high-speed control system. It was powered by a Westinghouse J40 jet engine with afterburner.

During the early flights with the prototype it became apparent that a number of design changes and modifications would be necessary and because of the delays which would result, the U.S. Navy cancelled a production contract for 100 F10F-1's.

The original pre-production order for eleven aircraft has since been cancelled and the entire project abandoned. The only XF10F-1 to be completed made its first flight on May 19, 1953.

THE GRUMMAN G-93 COUGAR.
U.S. Navy designation: F9F.

The Cougar is a swept-wing development of the F9F Panther. The fuselage is similar to that of the Panther, but new swept wings and tail-unit are incorporated.

There are two versions of the Cougar :—

F9F-6. One Pratt & Whitney J48-P-8 (7,200 lb.=3,270 kg. s.t.) with afterburner. Prototype first flew on September 20, 1951. F9F-6P is photographic reconnaissance aircraft with longer nose containing camera equipment.

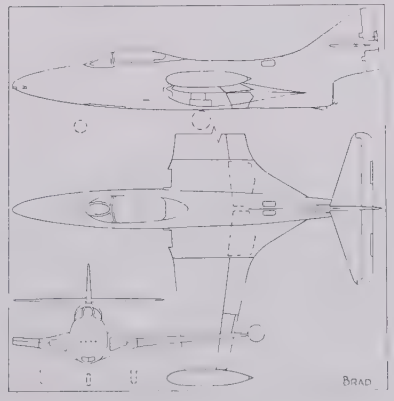
F9F-7. One Allison J33-A-16 engine. No other details have been released but the external characteristics of the Cougar may be seen in the accompanying illustration.

F9F-8. Modified F9F-6 with design changes in rear end of fuselage and at wing filets. No further details.

F9F-9. This designation has been given to a new design (G-98), of which no details were available at the time of writing.

THE GRUMMAN G-79 PANTHER.
U.S. Navy designation : F9F.

The original layout of this aircraft provided for the installation of four wing-mounted Westinghouse 19XB-2B (Navy J-30) axial-flow jets, but this arrangement was abandoned in favour of one fuselage-mounted high-powered jet engine before the prototype construction began, a change prompted by the successful tests conducted by the U.S. Navy at the Naval Air Materiel Center, Philadelphia, in December, 1946, with two imported Rolls-Royce Nene engines.



The Grumman F9F-5 Panther.

The first prototype XF9F-2 was powered with an imported Rolls-Royce Nene engine. The third prototype was similarly fitted, but the second, the XF9F-3, had the Allison J33 engine.

F9F-2. One Pratt & Whitney J42-P-6 (5,000 lb.=2,270 kg. s.t.). Two prototypes (XF9F-2) built, the first flying for first time on November 24, 1947. Ordered jointly with F9F-3. First production F9F-2 flew on November 24, 1948.

F9F-3. One Allison J33-A-8 (4,600 lb.=2,090 kg. s.t. dry). Prototype flew on August 15, 1948. Ordered jointly with F9F-2. Joint contracts for F9F-2 and -3 totalled 418.

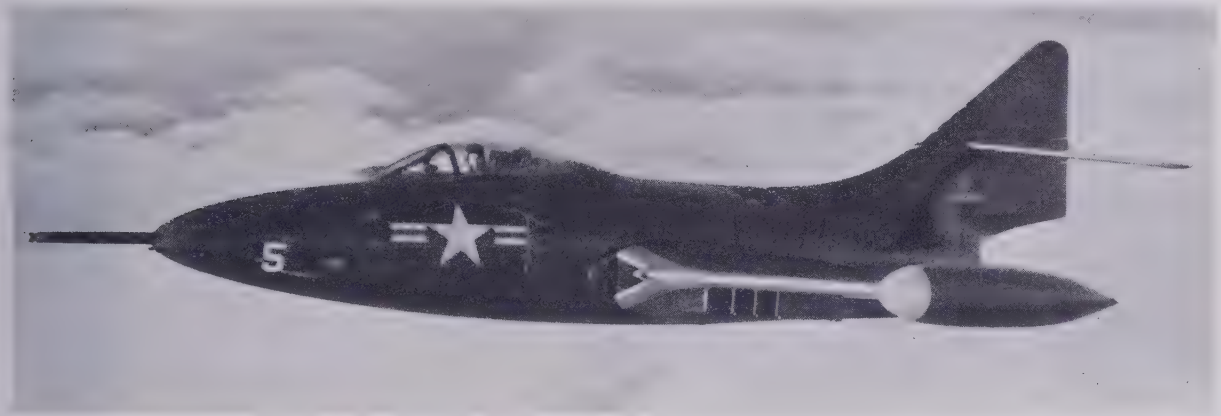
F9F-4. One Allison J33-A-16 (5,850 lb.=2,656 kg. s.t. dry). Original contract for 73. Subsequent contracts combined with F9F-5 in unspecified quantities.

F9F-5. One Pratt & Whitney J48-P-4 (6,250 lb.=2,840 kg. s.t. dry). Redesigned with larger fuselage and higher tail. The prototype, a modified F9F-2, first flew on December 21, 1949. F9F-5P is photographic reconnaissance version with longer camera nose.

TYPE.—Single-seat Naval Carrier-based Jet-propelled Fighter.

WINGS.—Low-wing cantilever monoplane. All-metal structure with flush-riveted stressed skin. Trailing-edge flaps inboard of ailerons and beneath fuselage. Variable-camber leading-edge flaps inter-connected with trailing-edge flaps. Hydraulic-operation. Upward-folding wings for carrier stowage.

FUSELAGE.—All-metal structure with flush-riveted stressed skin. Quickly detachable nose for servicing equipment and for interchangeability of armament, photographic and electronic equipment. Tail section quickly removable for access to engine compartment.



The Grumman F9F-5 Panther Naval Fighter with Flight-refuelling Probe. (*Harold Martin*).



The Grumman F9F-5P Panther Photographic Reconnaissance Monoplane with under-wing long-range tanks. (*Harold Martin*).

TAIL UNIT.—Cantilever monoplane type. Fin integral with fuselage. Tailplane mounted halfway up fin. All-metal structure.

LANDING GEAR.—Retractable tricycle type. Main wheels raised inwardly into thickened wing roots, nose wheel backwards into fuselage. Hydraulic retraction. Retractable arrester hook in rear end of fuselage below jet outlet.

POWER PLANT.—One Pratt & Whitney J42 or J48 or Allison J33 turbojet in plenum chamber amidships with air inlets in thickened wing-roots and jet exit beneath rear end of fuselage. Four spring-loaded blower doors in sides of plenum chamber may be opened to induce accelerated air-flow through chamber at low flying speeds at take-off and landing to eliminate stalling of air at lower lip of duct intakes at coarse angles of attack. Two additional doors aft release ram pressure in plenum chamber in the event of pressure seal failure. Fuel in internal and wing-tip tanks. Latter are permanent to ensure cleaner fit and to get over difficulty of jettisoning both tanks simultaneously. Fuel can be jettisoned in emergency by ram air valved into front of tanks. Probe-drogue in-flight refuelling equipment.

ACCOMMODATION.—Pilot's pressurised cockpit forward of wings with sliding and jettisonable canopy. Heating and refrigeration, pilot's ejector seat.

ARMAMENT. -Four 20 mm. nose-mounted cannon. May also carry external stores in the form of 5 in. rockets, 500 lb. bombs, Napalm bombs, etc.

DIMENSIONS (F9F-2 and -3).
Span 38 ft. (11.6 m.).
Length 40 ft. (12.2 m.).
Height (over tail) 15 ft. (4.5 m.).

DIMENSIONS (F9F-4 and -5).—
Span 38 ft. (11.6 m.).
Length 42 ft. (12.8 m.).
Height 16 ft. (4.8 m.).

WEIGHT.—
Designed loaded weight 15,750 lb. (7,150 kg.).

PERFORMANCE (F9F-5).—
Max. speed about 625 m.p.h. (1,000 km.h.).
Initial rate of climb approx. 9,000 ft./min. (2,745 m./min.).
Service ceiling over 50,000 ft. (15,250 m.).

THE GRUMMAN G-89.
U.S. Navy designation : S2F-1.

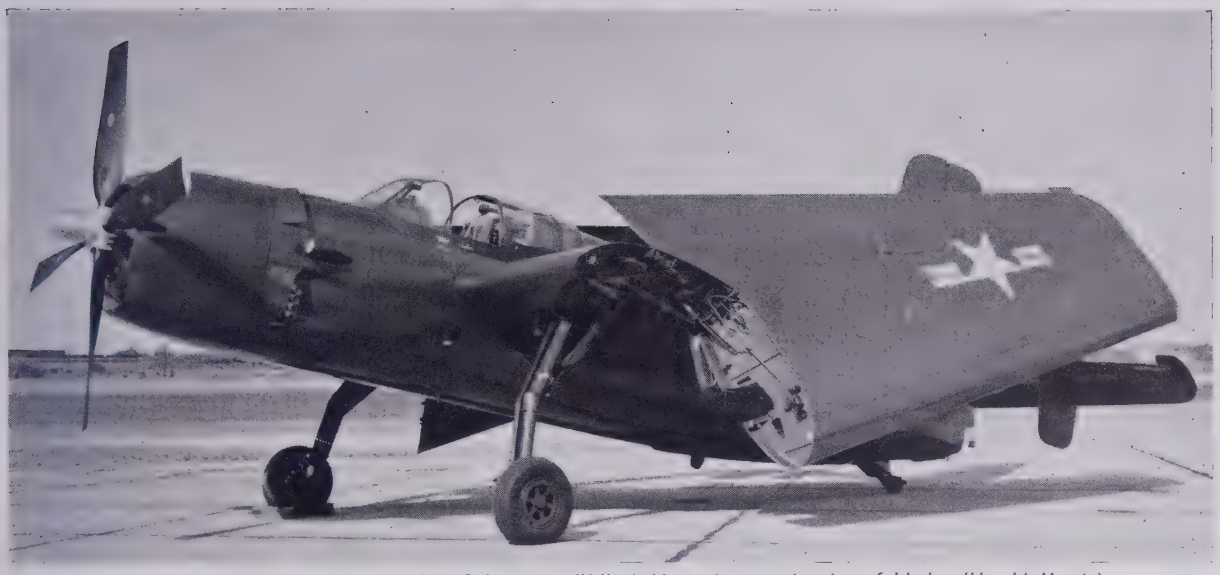
The S2F-1 is a twin-engined carrier-based Anti-Submarine aircraft which is now in production for the U.S. Navy. The prototype X2SF-1 made its first flight on December 4, 1952.

The S2F-1 is a high-wing monoplane which is powered by two Wright R-1820 engines. The tricycle landing-gear has a dual-wheel nose-wheel unit and there is a small wheel-bumper aft which is extendable but not fully retractable. A split rudder has been developed for the S2F-1 to assist single-engine performance.

There is a retractable radome under the rear fuselage behind a large bomb-



The Grumman S2F-1 Anti-Submarine Monoplane (two Wright R-1820 engines).



The Grumman AF-2S Guardian Anti-Submarine (Killer) Monoplane with wings folded. (*Harold Martin*).

bay, and the engine nacelles are used for the stowage of expendable submarine-detection equipment.

No other details of this aircraft had been released for publication up to the time of going to press.

THE GRUMMAN G-82 GUARDIAN.

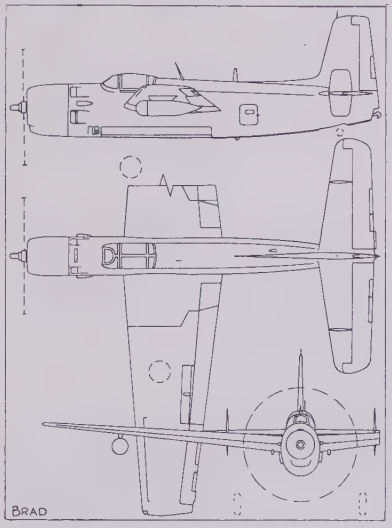
U.S. Navy designation: AF.

Originally designated the XTB3F-1 (G-70), this aircraft was designed as a torpedo-bomber to have a composite power-plant consisting of one Pratt & Whitney R-2800-34W engine in the nose and one Westinghouse 19XB-2B jet unit in the rear fuselage and exhausting under the tail.

During evaluation trials considerable modifications were made to the XTB3F-1 to change its function from that of torpedo-bomber to anti-submarine duties, and in 1949 two new prototypes incorporating all changes were built, these carrying the designations XTB3F-1S and XTB 3F-2S, the former equipped as a submarine hunter and the latter as a killer.

A production order for aircraft of both types was placed by the U.S. Navy under the designations AF-1S and AF-2S, but before completion of the first AF-1S its designation was changed to AF-2W.

The AF-2W is equipped with electronic devices and serves as a submarine hunter, while the AF-2S carries bombs and other stores to destroy the enemy when located. In 1952-53 the AF-35 with additional submarine-detection gear was produced.



The Grumman AF-2S Guardian.

The Guardian went out of production in March, 1953.

TYPE.—Single-engined multi-seat Anti-submarine Monoplane in two versions, Hunter (AF-2W) and Killer (AF-2S).

WINGS.—Mid-wing cantilever monoplane. Wing section NACA 23018 at root, NACA 23012 at tip. Aspect ratio 6.56. Taper ratio 2 : 1. Thickness ratio 1.6 : 1. All-metal structure. Outer wing sections fold back hydraulically about the centre-section rear spar hinges and when stowed lie parallel to fuselage with leading-edges downward. Slotted flaps between ailerons and fuselage. Spoiler flaps. Leading-edge slats ahead of ailerons. Gross wing area 560 sq. ft. (52 m.^{2}).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Auxiliary fin surfaces above and below tailplane.

LANDING GEAR.—Retractable type. Main wheels retract outwardly into outer wings. Dual tail-wheels non-retractable. Catapult points under wings. Sting-type arrester hook.

POWER PLANT.—One 2,400 h.p. Pratt & Whitney R-2800-48W fourteen-cylinder radial air-cooled engine driving a four-blade Hamilton Standard constant-speed airscrew 13 ft. 2 in. (4.01 m.) in diameter. Engine thrust-line at −3 degrees to datum.

ACCOMMODATION.—Crew of three, comprising pilot and two radar operators in AF-2W; or pilot, navigator/bomb-aimer and radar operator in AF-2S.

EQUIPMENT (AF-2W).—Large search and early-warning radome beneath forward fuselage.

EQUIPMENT (AF-2S).—Internal stowage for various offensive stores, which may include one 2,000 lb. (908 kg.) torpedo, or two 1,600 lb. (726 kg.) depth charges, or two 2,000 lb. (908 kg.) bombs. Any of these stores can be duplicated and carried externally beneath wings. Searchlight under port wing and radar scanner under starboard wing, both in identically-shaped casings.



The Grumman AF-2W Guardian Anti-Submarine (Hunter) Monoplane. (*Warren Bodie*).



The Grumman SA-16A Albatross Rescue Triphibian (two 1,425 h.p. Wright R-1820 engines). (*Harold Martin*).

DIMENSIONS.-
Span 60 ft. 8 in. (18.5 m.).
Length 43 ft. 4 in. (13.2 m.).
Height 16 ft. 2 in. (4.93 m.).
WEIGHTS (Approx.).—
Weight empty 14,600 lb. (6,630 kg.).
Weight loaded 25,000 lb. (11,350 kg.).
PERFORMANCE (Approx.).—
Max. speed 315 m.p.h. (504 km.h.).
Stalling speed 83 m.p.h. (133 km.h.).
Range 1,500 miles (2,400 km.).

THE GRUMMAN G-64 ALBATROSS.
U.S. Air Force designation : SA-16A.
U.S. Navy and Coast Guard designation: UF-1.

The Albatross is now in production principally for the U.S.A.F. (SA-16A) as a "triphibian" for Sea Rescue duties. This version incorporates a sprung ski under the hull and small skis under each wing-tip float to enable the aircraft to land on and take-off from land, water, ice and snow.

A limited number of Albatross general utility amphibians are still being supplied to the U.S. Navy and U.S. Coast Guard under the designation UF-1.

TYPE.—Twin-engined General Utility triphibian or amphibian flying-boat.

WINGS. High-wing cantilever monoplane. All-metal structure. Wing in three sections a centre-section permanently attached to hull and two outer sections. Wing area 833 sq. ft. (77.5 m.²).

HULL.—Two-step all-metal hull.

TAIL UNIT.—Cantilever monoplane type. Fin integral with hull. Tailplane span 29 ft. (8.84 m.).

LANDING GEAR. Retractable nose-wheel type. Main wheels raised into sides of hull, twin nose wheels into nose of hull. Hydraulic retraction. Wheel track 17 ft. 8 in. (5.38 m.). Wheelbase 17 ft. 6 in. (5.34 m.). "Triphibian" gear (SA-16A) consists of a single ski 15 ft. (4.57 m.) long and 12 in. (0.305 m.) wide attached to bottom of hull. The rear portion 7 ft. (2.13 m.) long is hinged and sprung by oleo struts to cushion landings and to permit nose to rise in take-offs. Wing-tip floats have extended skis.

POWER PLANT.—Two Wright R-1820-76A nine-cylinder radial air-cooled engines each with a normal rating of 1,275 h.p. from S.L. to 3,000 ft. (915 m.), 975 h.p. at 14,700 ft. (4,480 m.) and with 1,425 h.p. available for take-off. Three-blade Hamilton Standard constant-speed and reversing airscrews. Internal fuel in two tanks in centre-section outboard of hull with total capacity of 675 U.S. gallons (2,550 litres). Drop tanks of 100, 150 or 300 U.S. gallons (378, 567 or 1,135 litres) each may be carried on bomb-racks under centre-section, one on each side of hull. Each wing-tip float can carry a further 200 U.S. gallons (756 litres).

ACCOMMODATION.—Crew of four/six, pilot, co-pilot, navigator, radio/radar operator and, on special hospital missions, two medical attendants. Cabin may be adapted for various missions. As an ambulance 12 stretchers can be carried and for transport work 10 passengers in addition to crew of four. With seats removed cargo or special equipment can be accommodated. A "dutch-type" door is provided on port side for sea rescue operations or for loading stretchers. Door is split horizontally, the lower half being left in place to give higher freeboard in rough weather. A rescue platform may be attached to bottom door sill from which a crewman secured by safety belt may haul persons aboard from water. Smaller emergency door on starboard side. Both doors may be used for oblique photography and for handling sea anchor. Hatch in roof to facilitate loading of freight. Three life-rafts carried, two in cabin, and one of automatically inflatable type in compartment in top of hull aft of wing. Auxiliary power-plant in compartment aft of main cabin. Lavatory and tail compartment for stowing equipment and gear.

EQUIPMENT.—Racks under each wing can carry bombs, auxiliary fuel tanks, rescue boat or other packaged equipment. Radome on nose of hull. Provision for Jato units to be attached to cabin doors from inside of hull. Stowage for four Jato units below cabin floor between wheel wells. Stowage for two parachute flares in tail compartment. Separate oxygen supplied for crew and passengers with 20 outlets for oxygen masks in cabin.

DIMENSIONS. —
Span 80 ft. (24.4 m.).
Length 60 ft. 8 in. (18.5 m.).
Height 24 ft. 3 in. (7.3 m.).
WEIGHTS AND LOADINGS.—
Weight empty 20,100 lb. (9,125 kg.).
Weight loaded 27,025 lb. (12,270 kg.).
Wing loading 32.4 lb./sq. ft. (158.1 kg./m.²).
Power loading 10.6 lb./h.p. (4.81 kg./h.p.).
PERFORMANCE.—
Max. speed at S.L. 247 m.p.h. (395 km.h.).
Max. speed at 18,800 ft. (5,735 m.) 264.5 m.p.h. (423 km.h.).
Cruising speed 225 m.p.h. (360 km.h.).
Stalling speed 79 m.p.h. (126.4 km.h.).
Initial rate of climb 1,400 ft./min. (427 m./min.).
Take-off distance at S.L. (no wind) 900 ft. (275 m.).
Take-off distance against 25 m.p.h. (40 km.h.) wind (off land) 330 ft. (100 m.).
Range (with 600 U.S. gallon=2,270 litres external fuel) 2,700 miles (4,320 km.).
Endurance (with 600 U.S. gallon=2,270 litres external fuel) 22.9 hours.



The Grumman UF-1G Albatross Rescue Amphibian. (*Harold Martin*).

GYRODYNE

GYRODYNE COMPANY OF AMERICA, INC.

HEAD OFFICE AND WORKS: ST. JAMES, LONG ISLAND, N.Y.

President: Peter J. Papadakos.

Vice-Presidents: E. J. Huber, D. W. MacVicar and Rear Admiral James D. Barner (U.S.N. Ret.).

Comptroller: Joseph J. Dorn.

Secretary and Treasurer: Nicholas Xanthaky.

The Gyrodyne Company of America, Inc. (originally organised under the name P.C. Helicopter Corpn). was incorporated in New York State on August 7, 1946. The company was formed for the purpose of developing advanced types of rotary-wing aircraft.

Four types are under development. These are a six-seat co-axial helicopter; a twelve-seat transport convertoplane known as the Helidyne; a sixteen-passenger transport Helidyne; and a 54-passenger Gyroliner.

The G.C.A. Model 2 co-axial helicopter, was originally the Model J helicopter which was built by and purchased from the now-defunct Helicopters, Inc. It has been the subject of considerable experimentation. It is now being flight-test evaluated under a U.S. Navy contract. The twelve and sixteen-passenger Helidyne transports and the 54-passenger Gyroliner are still in the design stage.

The Gyrodyne company is also undertaking sub-contract work in connection with the defense programme.

THE G.C.A. 2C.

TYPE. Six-seat Two-blade Co-axial Helicopter.

ROTORS.—Two two-blade co-axial oppositely-rotating rotors 48 ft. (14.64 m.) in diameter. Rotor blade chord 1 ft. 6 in. (0.45 m.). Wooden construction.

FUSELAGE.—Aluminium-alloy structure including skin.

LANDING GEAR.—Three-wheel type.

POWER PLANT.—One 450 h.p. Pratt & Whitney R-985-B4 Wasp Jr. nine-cylinder radial fan-cooled engine. Fuel capacity 100 U.S. gallons (378 litres). Gear reduction to rotors 12 : 1.

ACCOMMODATION.—Enclosed cabin seating pilot and five passengers.

DIMENSIONS.—
Rotor diameter 48 ft. (14.64 m.).
Height overall 14 ft. 4 in. (4.36 m.).

WEIGHTS AND LOADINGS.—
Empty 3,600 lb. (1,635 kg.).
Loaded 5,400 lb. (2,450 kg.).
Disc loading 2.98 lb./sq. ft. (14.54 kg./m.²).
Power loading 12 lb./h.p. (5.45 kg./h.p.).

PERFORMANCE.—
Max. speed 110 m.p.h. (176 km.h.).
Cruising speed 89 m.p.h. (142 km.h.).
Best rate of climb 1,460 ft./min. (445 m./min.).
Vertical rate of climb 840 ft./min. (256 m./min.).
Ceiling (vertical flight) 7,000 ft. (2,135 m.).
Cruising range 270 miles (430 km.).

THE G.C.A. 3 HELIDYNE.

The Helidyne is intended to combine the features of both the helicopter and the aeroplane. For this purpose the craft is fitted with a wing surface and two engines which drive both the rotors and normal airscrews through clutches. At low speeds and for landings and take-offs the Helidyne performs as a helicopter. For fast forward flight the airscrews are engaged, the wing picks up lift, so unloading the rotors, and the aeroplane type tail-unit becomes effective. Thus the Helidyne converts from a helicopter to an aeroplane as its forward speed increases. When the transition is complete the major portion of the lift is carried by the wing, the rotors functioning for lateral control only.

The Model 3 Helidyne will have accommodation for a crew of two and sixteen fully-equipped troops or twelve stretcher patients and an attendant. The all-metal fuselage will be fitted with stub wings, on which will be mounted the two 600 h.p. Pratt & Whitney engines driving pusher airscrews direct and the rotor transmission through clutches. The mounting of the engines outside the fuselage improves cooling and simplifies maintenance.

The design will feature clam-shell doors at the rear end of the fuselage, together with overhead travelling crane and power hoist for loading while hovering.



The G.C.A. 2C Helicopter (450 h.p. Pratt & Whitney R-985 engine).

DIMENSIONS.—
Rotor diameter 52 ft. (15.86 m.).
Overall height 15 ft. (4.57 m.).

WEIGHTS (Designed).—
Empty 6,000 lb. (2,725 kg.).
Loaded 11,000 lb. (5,000 kg.).
Max. overloaded 12,800 lb. (5,810 kg.).

PERFORMANCE (Estimated).—
Max. speed 170 m.p.h. (259 km.h.) at 3,700 ft. (1,130 m.).

HELIO

THE HELIO AIRCRAFT COMPANY.

HEAD OFFICE: NORWOOD METROPOLITAN AIRPORT, NORWOOD, MASS.
President: Dr. L. L. Bollinger.
Vice-President: Dr. O. C. Koppen.

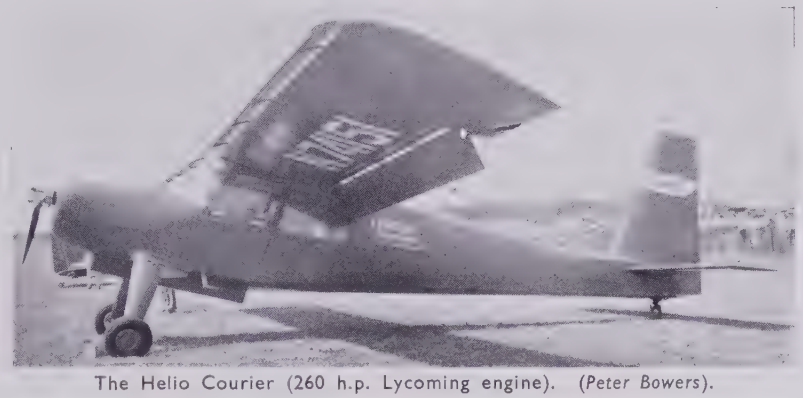
The Helio Aircraft Company was formed by Dr. Otto C. Koppen of the Massachussetts Institute of Technology, and Dr. Lynn Bollinger, of the Harvard Graduate School of Business Administration, to develop a light aircraft of greater potential utility than any existing type. Quick take-off and climb, high cruising speed, fully-controllable flight at low speeds, freedom from stall and spin, low landing speed, low noise level, etc., were some of the qualities aimed at.

A Piper Vagabond was used as a basis for the construction of a prototype incorporating features designed to achieve the qualities mentioned above, but during modification the plane took on an entirely new configuration. Span was reduced by 9 in., the fuselage was lengthened by 45 in., an additional door was added, the rudder was re-designed, the landing-gear was moved forward and auto-slats were incorporated in the leading-edge of wings. To increase flap area, the ailerons were arranged to droop with the flaps when needed, the ailerons still being operated by the control column no matter what position they may be in. The rudder was split into two sections, the lower section being interconnected to the aileron control while the upper section was operated conventionally by pilot. To overcome the increased drag of flaps on take-off a 9-foot diameter Aeromatic airscrew with wide blades and constant-speed control was designed by the Koppers Company in collaboration with Dr. Koppen. A special silencer was designed and patented by Dr. Koppen for incorporation in the power-plant installation, and is located beneath the fuselage between the landing-gear struts. A Goodyear cross-wind landing-gear and oleo-pneumatic shock-absorbers were fitted.

The prototype, which was built by E. W. Wiggins, Norwood, Mass., first flew on April 8, 1949, and considerable test flying was conducted with this aircraft. On the basis of this experience the Helio Corporation designed a new four-seat aircraft known as the Helioplane-Four, which incorporated most of the features of the two-seat prototype.

The Helio-Four was later re-designed to meet present-day military and industrial requirements and to permit the use of a readily-available standard power-unit and airscrew.

In its new form the aircraft is known as the Helio Courier. It is now a cantilever high-wing monoplane, but retains the full-span automatic leading-edge slots and high-lift flap system of the earlier model, although the interconnection between the ailerons and lower portion of the rudder has been abandoned.



The Helio Courier (260 h.p. Lycoming engine). (*Peter Bowers*).

THE HELIO H-391 COURIER.
U.S. Army designation: YL-24.

The Courier is now in production. One aircraft, with the designation YL-24, has been delivered to the U.S. Army Field Forces for evaluation trials.

TYPE.—Four-seat cabin monoplane.

WINGS.—High-wing cantilever monoplane. NACA 23012 wing section. Aspect ratio 6. Dihedral 1½°. Incidence 3°. All-metal structure. Full-span automatic leading-edge slots. NACA single slotted all-metal flaps. Ailerons have duralumin frames and fabric covering. Gross wing area 231 sq. ft. (21.46 m.²).

FUSELAGE.—All-metal structure. Cabin section has steel-tube framework, rear section is a monocoque.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. There is no fixed tailplane.

LANDING GEAR.—Fixed tail-wheel type. Cantilever struts with oleo-pneumatic springing. Goodyear cross-wind castoring wheels and Goodyear brakes.

POWER PLANT.—One 260 h.p. Lycoming six-cylinder horizontally-opposed air-cooled engine. Hartzell 101 two-blade constant-speed airscrew.

ACCOMMODATION.—Cabin seats four in two pairs. Dual controls for front seats.

DIMENSIONS.—
Span 39 ft. (11.89 m.).
Height 8 ft. 10 in. (7.10 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,800 lb. (817 kg.).
Weight loaded 3,000 lb. (1,362 kg.).
Wing loading 13 lb./sq. ft. (63.4 kg./m.²).
Power loading 11.54 lb./h.p. (5.24 kg./h.p.).

PERFORMANCE.
Cruising speed 150 m.p.h. (240 km.h.).
Min. speed 35 m.p.h. (56 km.h.).
Take-off run under 100 yds. (91.5 m.).

HILLER

HILLER HELICOPTERS, INC.

HEAD OFFICE: 1,350, WILLOW ROAD, PALO ALTO, CALIFORNIA.

President: Stanley Hiller, Jr.

Vice-Presidents: A. J. M. Chadwick and A. W. B. Vincent.

Chief Engineer: James B. Edwards.

Secretary and Treasurer: I. T. Kitzmiller.

Hiller Helicopters, Inc. passed its tenth anniversary in 1952, a year which saw the company exceed military production schedules and re-enter the commercial helicopter field.

At the beginning of 1953 the company was engaged in the production of HTE-2 training helicopters for the U.S. Navy and H-23B evacuation type helicopters for the U.S. Army. It was also making preparations to produce the Model 12B utility helicopter for commercial use.

While rapidly accelerating its production programme, Hiller is continuing its extensive research programme, with the main emphasis on tip-powered jet propulsion.

The Hiller Hornet two-seat ram-jet-driven helicopter, which was first flown in 1950, has been ordered in a service evaluation quantity by the military services, and the original design has been modified to meet military specifications. Commercial production of the Hornet has been postponed pending further development and evaluation of the military design which is illustrated and described herewith.

Expansion of plant and facilities continued during 1952, with increased building area for engineering and research work.



A drawing of the Hiller YH-32 Hornet Military Helicopter.

THE HILLER MODEL HJ-1 HORNET.

U.S. Military designation: YH-32.

TYPE.—Two-seat Ramjet-driven Helicopter.

ROTOR SYSTEM.—Two-blade all-metal rotor. Solid extruded aluminium leading-edge and built-up magnesium trailing-edge. Hiller "Rotor-Matic" cyclic-pitch control system as used in the 260. Rotor blade area 18.2 sq. ft. (1.69 m.²). Rotor diameter 23 ft. (7 m.).

FUSELAGE.—Combination fibreglas and steel-tube structure. A cabin enclosure having a fibreglas and plastic laminate skin and Plexiglas windscreen can be installed and detached in a few minutes.

TAIL UNIT.—Small 1 ft. 2 in. (0.35 m.) diameter tail rotor used to provide directional control only.

LANDING GEAR.—Simple twin skid gear.

POWER PLANT.—Two Hiller 8RJRBC ramjet units attached to extremities of rotor blades by two shear-type bolts each. All electric and fuel connections of plug-in type. Each unit, which has no moving parts, develops 32 lb. (14.5 kg.) net thrust and weighs 11 lb. (4.9 kg.). Fuel is pressure fed to ramjets by separate pipes from tank in fuselage. Rotor must be spun up to 150 r.p.m. by auxiliary means before ramjets can be started. This done by small 1 h.p. gasoline engine which is started by rip-cord, but can be achieved by hand-cranking or small electric motor. Starting procedure is then as follows:—fuel flow valves are opened and starter button is depressed. This button activates a magneto which energises electrodes in the ramjet units, which then fire. When 50 r.p.m. is reached the helicopter may be taken off. Fuel capacity 52 U.S. gallons (196.5 litres).

ACCOMMODATION.—Open or enclosed accommodation for two side-by-side on cross-bench seat. Baggage compartment behind seat in cabin enclosure.

CONTROLS.—Hiller "Rotor-Matic" paddle control system with cyclic-pitch control column branched at upper end to make it accessible to both occupants. Collective-pitch levers, which also incorporate the fuel flow valve are located conveniently between the two occupants. Foot pedals are provided for directional control.

DIMENSIONS.—

Rotor diameter 23 ft. (7.0 m.).
Fuselage width 3 ft. 9 in. (1.14 m.).
Overall height 8 ft. (2.44 m.).

WEIGHTS.

Empty 430 lb. (163.4 kg.).
Max. allowable payload 500 lb. (345.2 kg.).
Loaded 1,200 lb. (417.6 kg.).

PERFORMANCE.—

Max. speed 76 m.p.h. (128 km.h.).
Initial rate of climb 830 ft./min. (335 m./min.).
Hovering ceiling in ground effect 4,000 ft. (1,220 m.).
Absolute ceiling 12,000 ft. (3,660 m.).
Normal still air range 31 miles (50 km.).



The Hiller H-23B Military Helicopter (200 h.p. Franklin engine).

THE HILLER MODEL 12B.

U.S. Army designation: H-23B.
U.S. Navy designation: HTE-2.

The Model 12B was conceived and developed primarily as a military helicopter for the evacuation of wounded, training and other military missions, and originally went into production as the H-23B for the U.S. Army and the HTE for the U.S. Navy.

The 12B was granted Approved Type Certificate No. 6H2 by the C.A.B. in November, 1951, and it is now in production as a utility helicopter for commercial use, as well as in the following military versions:—

H-23B. Air evacuation helicopter for the U.S. Army. Stretcher installation consists of two folding stretchers in heated carriers, one on each side of cabin. May also be used for training. Wide track skid landing-gear.

HTE-2. Two-seat training helicopter for U.S. Navy. Four-wheel landing-gear. Twenty HTE-2's supplied to the Royal Navy.

TYPE.—Two-seat Training or three-seat Utility Helicopter.

ROTOR SYSTEM.—Two-blade main rotor universally mounted on power shaft with small servo rotor, the latter connected directly through universally-mounted transfer bearing and simple linkage with pilot's control stick. Movement of control stick introduced to the servo rotor paddles positive or negative pitch changes and aerodynamic forces thus developed tilt the rotor head and produce the effect of cyclic pitch changes to the rotor blades. Two-blade anti-torque rotor at rear end of fuselage driven off engine through universal joint and shafting. Main rotor/engine



The Hiller HTE-2 Naval Training Helicopter (200 h.p. Franklin engine).

r.p.m. ratio 1 : 9.17. Anti-torque rotor/engine r.p.m. ratio 1 : 1.6. The blades are of solid wood laminations with a steel spar along the leading-edge for balance purposes. Covering is of fibreglas with a stainless-steel leading-edge.

FUSELAGE.—Fabricated sheet metal fully-stressed semi-monocoque platform structure supports the non-stressed cabin enclosure, seats and controls, engine mounting and landing-gear. Tail boom of beaded sheet metal with no internal stiffeners.

LANDING GEAR.—Wide-tread skid (H-23B and 12B) or four-wheel type (HTE-2). Skid gear has two small wheels at rear to facilitate ground handling. Skid track 7 ft. 6 in. (2.28 m.). Four-wheel type has Hiller air/oil shock struts.

POWER PLANT.—One 200 h.p. Franklin Model 6V4-200-C33 six-cylinder horizontally-opposed fan-cooled engine mounted with main shaft vertical on steel-tube quadrapod attached to fuselage platform by four bolts. Rotor transmission through single planetary gear assembly. Fuel capacity 28 U.S. gallons (106 litres).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Floor type cyclic pitch control columns with collective pitch levers on left side of seats. Electric trim on cyclic column and throttle friction adjustment on collective pitch levers. The H-23B casualty evacuation version carries two folding type litters, one either side of cabin. Litter carriers are heated. A convertible cabin or canopy is standard on the civil Model 12B. This model can be easily adapted for agricultural operations, using dust, spray or aerosol equipment.

DIMENSIONS.—
Main rotor diameter 35 ft. (10.67 m.).
Length 38 ft. 8 in. (11.8 m.).
Height to top of rotor head (on wheels) 9 ft. 10 in. (3.0 m.).
Height to top of rotor head (on skids) 9 ft 6 in. (2.89 m.).
Diameter of tail rotor 5 ft. 6 in. (1.67 m.).

WEIGHTS AND LOADINGS.—
Weight empty (12B) 1,656 lb (752 kg.).
Weight empty (H-23B) 1,737 lb. (788.5 kg.).
Weight empty (HTE-2) 1,754 lb. (796 kg.)
Disposable load (12B) 844 lb. (383 kg.).
Weight loaded 2,500 lb. (1,135 kg.).
Disc loading 2.6 lb./sq. ft. (12.68 kg./m.²).
Power loading 12.5 lb./h.p. (5.67 kg./h.p.).
Disposable load (H-23B) 763 lb. (346.5 kg.).
Disposable load (HTE-2) 746 lb. (339 kg.).

PERFORMANCE.—
Max. speed 84 m.p.h. (134.4 km.h.).
Cruising speed 70 m.p.h. (112 km.h.).
Max. rate of climb 770 ft./min. (235 m./min.).
Hovering ceiling in ground effect 3,200 ft (976 m.).
Absolute ceiling 9,400 ft. (2.867 m.).
Range 135 miles (216 km.).

HOPPI-COPTER

HOPPI-COPTERS, INC.

HEAD OFFICE : 713 1411, 4th AVENUE BUILDING, SEATTLE 1, WASH.

PLANT : BOEING FIELD, SEATTLE, WASH.

President : T. H. MacLachlan.

Vice-President : Frank Goodwin.

Secretary and Treasurer : William Gail.

Hoppi-Copters, Inc., was formed on December 8, 1945, to develop and test a novel form of light helicopter. The first model built in 1945, was strapped to the wearer's back and weighed about 90 lb. (40.86 kg.). With a small 15-20 h.p. engine and two 12 ft. (3.66 m.) co-axial rotors, this piece of apparatus was stated to lift a load of 200 lb. (90.8 kg.).

The second Hoppi-Copter, Model 101, was equipped with a seat and landing gear and tests with this model suggested many modifications which were incorporated in Models 102, 103 and 104, which were equipped with engines of slightly greater horsepower (35) and rotors of slightly greater diameter (16 ft.). Further tests conducted on Model 103 indicated that greater horsepower than originally planned would be necessary. Obtaining such an engine of the light weight required has considerably delayed development and the production of a type model.

Models 102 and 104 were loaned to the British Ministry of Supply in 1948 for experimental purposes.

During 1951, Model 103C was rebuilt with several improvements, including the installation of a new engine of greater horsepower than previously used and other changes necessitated by the increased power. Tests conducted with this model provided important data.

Experimental work continued during 1952 and plans were drawn up for the construction of a revised model, to incorporate the latest in helicopter requirements and the changes indicated by the tests conducted in 1951.

HUGHES

HUGHES AIRCRAFT COMPANY (Division of the Hughes Tool Company).

HEAD OFFICE AND WORKS : FLORENCE AVENUE AT TEALE STREET, CULVER CITY, CAL.

President : Howard Hughes.

Vice-President : General Ira C. Eaker.

Vice-President and General Manager : General Harold L. George.

Vice-President and Assistant General Manager : Charles B. Thornton.

Vice-President and Director, Electronics Research and Development : Dr. Dean E. Wooldridge.

Vice-President, Operations : Dr. Simon Ramo.

Director, Aeronautical Development : Rea E. Hopper.

Director, Aircraft Service and Flight Test : Colonel C. A. Shoop.

The Hughes Aircraft Company, a division of the Hughes Tool Company, was formed in 1936 by Mr. Howard Hughes, to develop a racing monoplane with which he had established the International Landplane Speed Record of 352.46 m.p.h. (563.2 km.h.) on September 13, 1935.

The Hughes Flying-boat, the largest aeroplane in the World, was begun in 1942 at the company's Culver City plant and was moved to Long Beach, California, for assembly in June, 1946.

The boat was launched on November 1, 1947, and on the following day, on its third taxying test in Los Angeles harbour, Mr. Hughes lifted the aircraft off the water and flew for a distance of about one mile at an altitude of from 70 to 80 ft.

The Hughes flying-boat, which has a span of 320 ft. (97.6 m.) and a length of 219 ft. (66.8 m.), is of all-wood construction and is powered with eight 3,000 h.p. Pratt & Whitney R-4360 Wasp Major 28-cylinder radial air-cooled engines. It is capable of carrying 700 persons and has an all-up weight of approximately 400,000 lb. (181,600 kg.).

Since its first flight in November, 1947, the boat has been in dock where considerable experimental work has been done. During this period Mr. Hughes has substituted a new type of cradle which is designed to facilitate launchings and dockings, and he has meanwhile erected over the entire flying-boat an all-metal hangar of unique design. In 1952 it was reported that eight new engines would be installed before any further flying would be made.

Mr. Hughes has to date spent more than 22 million dollars of his own money to bring this government project towards completion.

The company's major activities are now directed towards the research, development and production of electronic equipment. The experimental department is engaged in the development of the XH-17, a large heavy-duty jet-driven helicopter for the U.S.A.F.

THE HUGHES XH-17.

The XH-17 is an experimental heavy lift helicopter which has been built under contract to the U.S.A.F. Built primarily



The Hughes XH-17 Experimental Heavy-Lift Jet-driven Helicopter.



The Hughes XH-17 Heavy-Lift Helicopter, showing how the craft can stradle and lift its load.

as a ground test model, the XH-17, after satisfactory tests of the jet-powered rotor mechanism, was converted into a flight test article and on October 23, 1952, it made its first flight.

The rotor of the XH-17 has a diameter of over 125 ft. (38.12 m.) and the craft is powered by two modified turbojet engines, developed and built by General Electric, which supply gas pressure through ducts leading up the rotor shaft and out of the tips of the rotor blades. The overall height of the XH-17 is over 30 ft. (9.15 m.).

The XH-17 is expected to be the forerunner of powerful cargo-carrying helicopters designed to lift and deliver such heavy equipment as artillery, bridge sections and trucks into areas unaccessible to conventional aircraft.

KAMAN

KAMAN AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: BRADLEY FIELD, WINDSOR LOCKS, CONNECTICUT.

President: Charles H. Kaman.

The Kaman Aircraft Corpn. was formed on December 12, 1945, to develop a new helicopter rotor and control system evolved by Mr. Charles H. Kaman.

The basic development of an intermeshing rotor system and servo flap control was completed late in 1946 and the first flight of the Kaman K-125A experimental helicopter was made on January 15, 1947. This was followed by the K-190, which flew in April, 1948. In December of that year the C.A.A. gave structural approval for the production of the K-225 utility helicopter, and certification of this model was granted by the C.A.A. in April, 1949.

In 1949 Kaman was awarded a research contract by the U.S. Navy, calling for the evaluation of the flight stability and handling characteristics of the K-225.

In 1950 Kaman received two production contracts from the U.S. Navy for two new types of helicopter using the same type of intermeshing rotors and servo rotor control which have characterised Kaman helicopters since their inception. These contracts are for undisclosed quantities of HTK-1 three-seat trainers and HOK-1 four-seat liaison helicopters.

Under a U.S. Navy contract Kaman has developed and is testing over an extended period a K-225 helicopter powered with a 175 h.p. Boeing YT50 (Model 502-2) gas-turbine engine. This helicopter, which flew for the first time on December 10, 1951, is the first in the World in which the rotors are driven by turbine power.



The Kaman HTK-1 Three-seat Training Helicopter.

THE KAMAN HTK-1.

The HTK-1 three-seat helicopter is in production for the U.S. Navy and Marine Corps primarily as a trainer, but it is adaptable for ambulance, or evacuation duties. It differs from the K-225 commercial utility model by having rotor blades of greater length and a horizontal tail surface connected to the collective pitch control for great stability. Power is supplied by a 240 h.p. Lycoming O-435 engine.

For evacuation duties the HTK-1 can carry a pilot and two stretcher cases, one above the other on the left side of the cabin. The left half of the transparent cabin nose opens to facilitate the loading of the stretchers. The change-over from three-seat trainer to ambulance can be made in 2½ minutes.

This helicopter has been awarded a C.A.A. Approved Type Certificate (1H3) and has a commercial designation (K-240) but it will not be produced in civil form until military commitments permit.

DIMENSIONS.—
Rotor diameter (both) 40 ft. (12.20 m.).
Distance between rotor heads 4 ft. 10 in. (1.47 m.).
Length of fuselage (over fins) 20 ft. 6½ in. (6.25 m.).
Span of tail 8 ft. 0 in. (2.44 m.).
Wheelbase 6 ft. 2 in. (1.88 m.).
Track (rear wheels) 7 ft. 6 in. (2.28 m.).
Track (front wheels) 5 ft. 2 in. (1.57 m.).

WEIGHTS AND PERFORMANCE.—
No data available.



The Kaman HOK-1 Four-seat Liaison Helicopter. (*Levy-Shipp*).

THE KAMAN HOK-1.

The HOK-1 is a four-seat liaison helicopter which is in production for the U.S. Navy. This contract was the result of success in a Navy-sponsored design competition for a liaison-type helicopter. This contest took place at the same time as the U.S. Navy was conducting evaluation flight tests with a standard K-225 helicopter. The results of these tests with a craft using the same rotor system as that incorporated in the competitive design had their influence on the final award of the contract.

The HOK-1 will normally carry four persons but as an ambulance it will accommodate two stretcher patients and

one sitting patient or medical orderly, in addition to the pilot. Stretcher loading will be through the nose as in the HTK-1.

The HOK-1 is powered by a 500 h.p. Continental R-975-40 radial engine which is mounted at the rear end of the fuselage at an angle of 35° from the horizontal to give direct drive to the dual rotor gear box in the roof. The engine is fan-cooled with the shutter-controlled main air inlet between the rotor pylons. Large rear fuselage doors give complete access to the power-plant.

The two rotors can be lined up parallel to each other fore and aft for stowage purposes.



The Kaman HOK-1 Four-seat Liaison Helicopter. (*Levy-Shipp*).

THE KAMAN K-225.

TYPE.—Three-seat Utility Helicopter.

ROTORS. — Two two-blade contra-rotating intermeshing rotors. Rotor hub of "see-saw" type employing only blade lag hinges, the solid spruce-blades being fitted with servo flaps which eliminate blade pitch-change and associated bearings. The movements of the servo flap twist the blade between the root and the ¾ radius station at which the flap is located, the natural resilience of the spruce blade being used to obtain torsional deflection. Inter-blade motion dampened by friction-type dampers. Control sticks and pedals connected to collective pitch forks and gimbal ring assemblies located at base of rotor shafts. Pilot control applied through these assemblies is transferred through push-pull rods inside hollow rotor shafts, through bell cranks at rotor hub to push-pull rods located in blade leading-edge and finally through bell-crank to servo-flap hinge. Cyclic control obtained by tilting gimbal-ring assembly, collective-pitch control raises and lowers two gimbal-ring assemblies simultaneously. Rudder pedals raise and lower two gimbal-ring assemblies alternatively.

FUSELAGE.—Welded steel-tube structure. Tail cone attached by four bolts and quickly removable to give access to engine for overhaul.

LANDING GEAR.—Nose-wheel type. Main wheels on cantilever air-oil legs attached at upper ends to cross tube member between lower fuselage longerons. Nose wheel, also on air-oil leg, is full-castoring and self-centering.

POWER PLANT.—One 225 h.p. Lycoming O-435 six-cylinder fan-cooled engine facing aft. Drive taken off engine nose through centrifugal clutch and spur gear (1.1 : 1 ratio) via drive shaft passing forward over engine to main transmission (10.5 : 1 gear ratio) via free-wheeling unit. Hydraulic rotor brake at free-wheeling unit. Gravity fuel system. Fuel capacity 32 U.S. gallons (121 litres).

ACCOMMODATION.—Open seats for pilot and two passengers. Pilot controls consist of cyclic stick, collective pitch stick incorporating throttle, and rudder pedals.

WEIGHTS.—
Weight empty 1,800 lb. (817 kg.).
Disposable load 900-1,200 lb. (409-545 kg.).
Normal gross weight 2,700 lb. (1,226 kg.).
Max. gross weight 3,000 lb. (1,362 kg.).

PERFORMANCE.—
Max. speed 73 m.p.h. (117 km.h.).
Cruising speed 65 m.p.h. (104 km.h.).
Best rate of climb 1,000 ft./min. (305 m./min.).
Vertical rate of climb 300 ft./min. (91 m./min.).
Autorotative rate of descent 1,250 ft./min. (381 m./min.).
Hovering ceiling in ground effect 6,000 ft. (1,830 m.).
Absolute ceiling 12,000 ft. (3,660 m.).



The Experimental Kaman K-225 Helicopter powered by a 175 h.p. Boeing YT50 gas-turbine engine.

KELLETT

THE KELLETT AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: CENTRAL AIRPORT, CAMDEN 11, NEW JERSEY.

Vice-President and Chief Engineer: C. A. Barnett.

Treasurer and Controller: J. N. Brown.

Secretary: G. P. Williams III.

The Kellett Aircraft Corporation was founded in 1929, and has since been engaged in the development of rotary-wing aircraft. The Company developed and supplied to the U.S.A.F. the first military autogiros, as well as the first autogiros to Brazil and Argentina.

The Company designed and developed the XH-8 and XH-10 helicopters for the U.S.A.F. It also designed the XH-17 large transport helicopter but the development of this design and the construction of the prototype was transferred to the Hughes Aircraft Company in 1948.

The Company's present activities consist of further development work on helicopters and aircraft engineering and manufacturing on a sub-contract basis.

Kellett currently holds a contract from the U.S. Navy to convert a 1939 Kellett KD-1B Autogiro into a flying test vehicle to investigate the flight of a partially-loaded rotor system to provide performance characteristics for a compound helicopter-type convertiplane.

LOCKHEED

THE LOCKHEED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: BURBANK, CALIFORNIA.

GEORGIA DIVISION: MARIETTA, GA.

OTHER FACTORIES: BAKERSFIELD, BEVERLY HILLS, PALMDALE AND VAN NUYS, CALIFORNIA.

Incorporated: 1932.

President and Chairman of Board: Robert E. Cross.

Executive Vice-President: Courtlandt S. Gross.

Vice-President and Assistant to President: Carl B. Squier.

Vice-President in charge of Administration: Cyril Chappellet.

Vice-President in charge of Engineering: Hall L. Hibbard.

Vice-President and Treasurer: C. A. Barker, Jr.

Vice-President and General Manager, California Division: Burt C. Monesmith.

Vice-President and General Manager, Georgia Division: Daniel J. Haughton.

Secretary: L. W. Wulfekuhler.

Controller: Dudley E. Browne.

The original Lockheed Aircraft Co. dates from 1916 when the brothers Allen and Malcolm Loughead, the founders, began with what was the forerunner of the true streamline aeroplane. The factory was moved to Burbank, Cal., the present site, in 1926, and the name changed to Lockheed.

On November 30, 1943, the Vega Aircraft Corporation, which had been formed in 1937 as an affiliate, and in 1941 became a wholly-owned subsidiary of the Lockheed Aircraft Corpn., was absorbed and the name Vega abandoned.

The company now employs nearly 48,000 persons, including over 11,000 at its new Marietta, Ga., division. The Marietta plant, a World War II government-owned facility, has been re-opened to build B-47 jet bombers and C-130A cargo transports.

In 1952, Lockheed began the expansion of its facilities at Palmdale, California. Plans call for Lockheed's present Palmdale facility, a single hangar, to be expanded to triple its present size and later to be developed under U.S. Air Force direction to a huge final assembly and flight test centre for jet aircraft.

Current Lockheed production includes the F-94 jet interceptor for the U.S.A.F.; the T-33 jet trainer for the U.S.A.F. (and numerous N.A.T.O. countries) and the TV-2 jet trainer for the U.S. Navy; the P2V Neptune for U.S. Navy; the Super-Constellation for airlines and the military services; and the B-47 jet bomber and C-130 turboprop medium cargo transport

for the U.S.A.F. Considerable research work in advanced flight fields is under way.

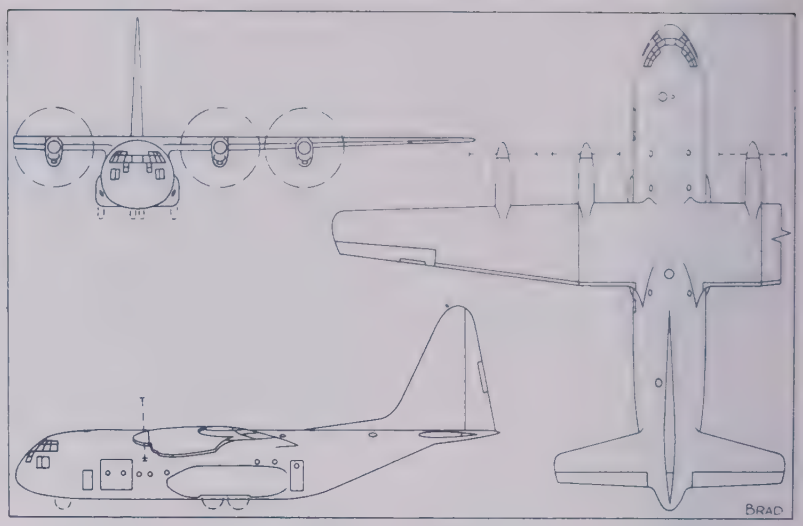
THE LOCKHEED C-130.

The C-130 is a medium cargo transport which is in production for the U.S.A.F. Two XC-130 prototypes are being built at Burbank while the production C-130A will be manufactured at Marietta, Georgia.

The C-130, which will be powered by four Allison T38 turboprop engines, has been designed for assault and support missions, carrying troops or supplies forward and returning casualties to the rear. As a troop carrier the aircraft may be used for paratroops or ground troops; as a cargo carrier it will be able to carry large pieces of equipment such as a 155 mm. howitzer and its high-speed tractor; and as an evacuation aircraft it can be rapidly converted to carry stretcher cases.

Aft of the main hold, which is only 45 in. (1.14 m.) from the ground, the rear fuselage is sharply upswept. In the upswept portion is a built-in loading ramp which serves as the rear door. This ramp can be lowered to truck-bed height for loading stores, or to the ground for wheeled and tracked vehicles to be driven in. The rear door can also be opened in flight for the air dropping of paratroops and equipment. There is also a large cargo-loading door ahead of the wings.

The tricycle landing-gear, with the main wheels in tandem, is designed to permit the C-130 to operate from small emergency landing fields or rough forward airstrips.



The Lockheed C-130 Transport (four Allison T38 turboprop engines).



The Lockheed Constellation 749 Airliner (four 2,700 h.p. Wright Cyclone engines).

DIMENSIONS (Approximate).—
Span 132 ft. (40.2 m.).
Length 95 ft. (28.9 m.).
Height 38 ft. (11.6 m.).

WEIGHTS AND PERFORMANCE.
No data available.

THE LOCKHEED CONSTELLATION AND SUPER CONSTELLATION.

U.S. Air Force designations: C-121 and RC-121.

U.S. Navy designations: WV and R7V.

The design of the original Model 49 Constellation was begun in June, 1939, to the requirements of Transcontinental & Western Air, Inc. During its development, and after consultation with T.W.A., Pan American Airways also ordered a number of Constellations but on the entry of the United States into the war both companies waived their rights in favour of the Army Air Forces, to whose requirements the Constellation was completed. The first Constellation to fly on January 9, 1943, was a C-69 military transport. The first Constellation to be built throughout as a commercial aeroplane was completed in 1947.

The following are the various currently-used and production versions of the civil and military Constellation:—

Model 49. First commercial version. Built from components of C-69 military Constellations cancelled on VJ-Day and modified for civil airline use. ATC No. 763 granted by C.A.B. on December 11, 1945. Gross take-off weight 96,000 lbs. (43,585 kg.). Landing weight 83,000 lbs. (37,680 kg.). Total fuel capacity 4,690 U.S. gallons (17,130 litres).

Model 649A. First Constellation built throughout as a commercial type. Four Wright Cyclone 749C18BD1 engines direct fuel-injection. Total fuel capacity 4,690 U.S. gallons (17,130 litres). More luxuriously furnished and has slightly greater maximum and cruising speeds. Gross take-off weight increased to 98,000 lbs. (44,490 kg.). Landing weight 89,500 lbs. (40,630 kg.). The Speedpak was first used in this model.

Model 749. Long-range version of the 649. Additional fuel tank (565 U.S. gallons = 2,135 litres) in each outer wing, to raise total fuel capacity to 5,820 U.S. gallons (22,000 litres). Range increased by 1,000 miles (1,600 km.) while carrying the same payload as the 649. Gross take-off weight 102,000 lb. (46,310 kg.).



The Lockheed Super Constellation 1049 Airliner (four 2,700 h.p. Wright Cyclone engines).



The Lockheed Super Constellation 1049C Airliner (four 3,350 h.p. Wright Turbo-Cyclone engines).

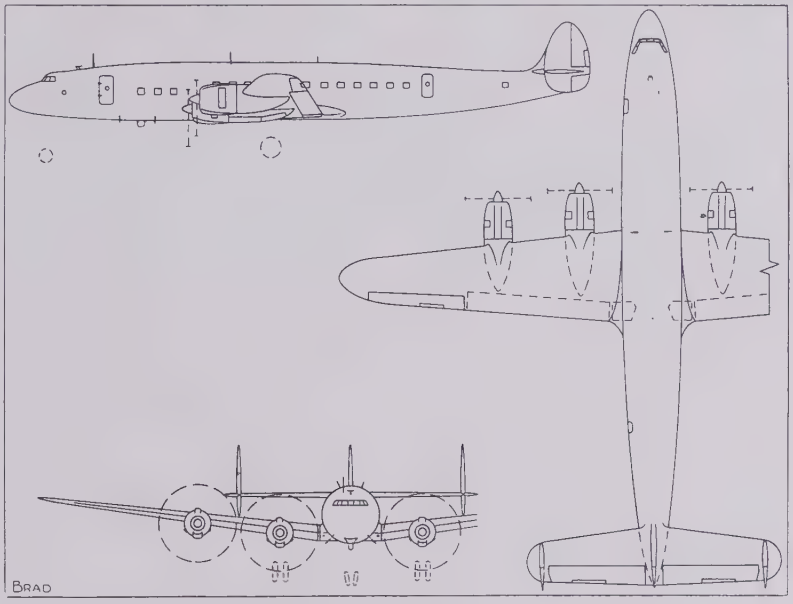
Landing weight 84,500 lb. (38,363 kg.).

Model 749A. Max. take-off weight 107,000 lb. (48,580 kg.), permitting use of Speedpak at any load factors up to range of 2,200 miles (4,520 km.). Fuel capacity 5,820 U.S. gallons (22,000 litres). Maximum landing weight 89,500 lb. (40,633 kg.).

Model 1049. First Super-Constellation. Fuselage lengthened by 18.4 ft. (5.6 m.). Four 2,700 h.p. Wright Cyclone 956C18 CA1 or CB1 engines. Fuel capacity 6,550 U.S. gallons (24,760 litres). Gross take-off weight 120,000 lb. (54,480 kg.). Landing weight 98,500 lb. (44,720 kg.). Will carry 92 passengers. Cruising speed 320 m.p.h. (512 km.h.). Fourteen were delivered to Eastern Air Lines and ten to Trans World Airlines in 1952. First prototype, a conversion of the original C-69 prototype, flew for the first time on October 13, 1950.

Model 1049B. Commercial cargo transport version of 1049 fitted with four 3,250 h.p. Wright Turbo-Cyclone 972TC 18DA1 engines. Has total usable cargo volume of 5,568 cub. ft. (156 m.^{3}) and a capacity for 36,200 lb. (16,435 kg.) of payload. Two large cargo loading doors, aft door 9 ft. 4½ in. × 6 ft. 2½ in. (2.85 m. × 1.89 m.), forward door 5 ft. 1½ in. × 6 ft. 4¾ in. (1.56 m. × 1.94 m.). Maximum T.O. weight 133,000 lb. (60,380 kg.). Maximum landing weight 110,000 lb. (49,940 kg.). Four ordered by Seaboard and Western Airlines.

Model 1049C. This is the 1049 fitted with four Wright Turbo-Cyclone 972C18 DA1 engines. First to incorporate Lockheed-Dreyfuss interior, the convertibility features of which make possible a 47-seat "siesta" version, a 59-63 passenger luxury version or a 94-seat tourist version. On domestic versions the compartment needed for extra crew on trans-Atlantic flights may be used for passengers so that capacities are slightly higher; up to 99 in tourist version. Gross take-off weight 133,000 lb. (60,380 kg.). Maximum landing weight 110,000 lb. (49,940 kg.). First Model 1049C flew for first time on February 17, 1953.



The Lockheed Super Constellation Model 1049 Airliner.

Model 1049E. Improved version of 1049C with same maximum take-off weight but with addition of all structural modifications (except to landing gear) to permit increase of maximum take-off weight to 150,000 lb. (68,100 kg.) when engines of higher power become available. Incorporates convertibility features of Lockheed-Dreyfuss interior.

The following airlines have ordered Model 1049C or 1049E Super-Constellations with turbo-compound engines:—K.L.M. 13, Air France 10, Pakistan International 3, Qantas Empire Airways 3, Trans-Canada Air Lines 8, Air India International 2, Eastern Air Lines 16, Braathens SAFE 1, Iberia Lineas Aereas Espanolas 3, Avianca 3, Linea Aeropostal Venezolana 2 and VARIG (Brazil) 3.

There are also nine military and naval versions of the Constellation and Super Constellation, brief details of which are given hereafter.

C-121A. Military cargo version of the Model 749.

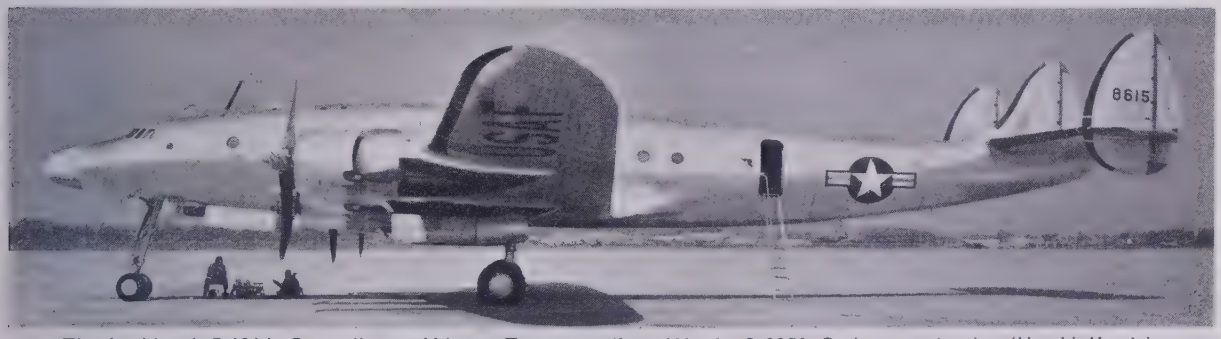
VC-121B. Military V.V.I.P. transport version of the Model 749.

C-121C. Military transport version of the Model 1049B.

RC-121C. U.S.A.F. version of WV-2.

RC-121D. Developed version of RC-121C.

WV-1 (formerly PO-1W). Modified 749 to test advanced electronic systems.



The Lockheed C-121A Constellation Military Transport (four Wright R-3350 Cyclone engines). (*Harold Martin*).



The Lockheed RC-121C Reconnaissance and Early-warning Intelligence aircraft (four 3,250 h.p. Wright R-3350 Turbo-Cyclone engines).

Two ordered by U.S. Navy. First flew on June 9, 1949.

WV-2 (formerly PO-2W). Production version of WV-1 to serve as a high-altitude reconnaissance and early-warning radar intelligence aircraft. Developed from Super Constellation and powered by four 3,250 h.p. Wright Turbo-compound engines.

R7V-1 (formerly R7O-1). U.S. Navy transport version of the Model L-1049B with four Wright R-3350-34W Turbo-Cyclone engines. Carries 106 passengers in backward facing 20G removable seats, up to 19 short tons of cargo, or 73 casualties on stretchers. A.U.W. 133,000 lb. (60,380 kg.). Large loading doors fore and aft of wings.

R7V-2 (formerly R7O-2). Two aircraft to be powered with four Pratt & Whitney T-34 turboprop engines for evaluation of this type of power-plant for transport aircraft. Will be fitted with two 600 U.S. gallon wing-tip tanks and will have provision for two additional 500 U.S. gallon underwing tanks, to give a total maximum fuel capacity of 8,750 U.S. gallons.

The following description applies mainly to the civil Model 1049. The structural description applies generally to all versions of the Constellation.

TYPE.—Four-engined Airliner.

WINGS.—Cantilever low-wing monoplane. All-metal structure in seven main sections consisting of centre-section, two inner wings carrying engine nacelles, two outer wings and detachable tips. Two-spar structure with flush-riveted stressed metal skin. All-metal ailerons each have controllable trim-tab and hydraulic boost control. Lockheed-Fowler trailing-edge flaps extend from ailerons nearly to centre-line of fuselage. Gross wing area 1,650 sq. ft. (153.5 m.²).

FUSELAGE. — All-metal semi-monocoque structure. Circular cross-section throughout length and with centre-line cambered for aerodynamic cleanliness.

TAIL UNIT.—Cantilever monoplane type, consisting of tailplane and two-piece elevator mounted at top of fuselage, and two inset fins and rudders with third fin and rudder on fuselage centre-line. All-metal structure with stressed metal skin on fins, tailplane and elevators. Metal-framed fabric-covered rudders. Controllable trim-tabs in rudders and elevators. Hydraulically-boosted control surfaces with manual override control for auxiliary use. Tailplane span 50 ft. 0 in. (15.24 m.).

LANDING GEAR.—Retractable tricycle type with dual wheels on all units. Dual hydraulic brake system on main wheels with manual auxiliary override control. Track (centre-line of legs) 28 ft. 0 in. (8.50 m.).

POWER PLANT.—Four Wright Cyclone 956C 18CA1 eighteen-cylinder two-row radial air-cooled engines each rated at 2,700 h.p. for take-off. Stainless-steel nacelles, with all ducting and controls grouped at fireproof bulkhead, are completely detachable and can be changed in 30 minutes. Automatic fire-detection and location with positive fire-extinguisher system operated by flight engineer. Hamilton Standard Hydromatic three-blade reversible airscrews, 15 ft. 2 in. (4.62 m.) diameter. Seven separate fuel systems in wings with total capacity of 6,550 U.S. gallons (24,760 litres). Total oil capacity 227 U.S. gallons (858 litres) in five separate tanks.

ACCOMMODATION.—Pressurized cabin for crew and passengers maintains 8,000 ft. (2,440 m.) cabin atmosphere at 22,800 ft. (6,955 m.). Two fully-automatic cabin superchargers with manual override control. Thermostatically-controlled heating and cooling. Refrigeration unit cools cabin to 80 degrees Fahrenheit with outside temperature at 99 degrees Fahrenheit. Pilot's compartment in forward portion of fuselage with pilot (on port) and co-pilot side-by-side with dual controls. Flight engineer behind co-pilot facing outboard. Radio-operator behind pilot. Two cabin attendants. Entry to crew compartment on starboard side. Aft of crew compartment is a section which may be used as a galley, buffet, etc. Next follows main passenger cabin, insulated against sound, vibration and outside temperature. Many alternative arrangements allow for tota laccommodation up to 106 passengers. Main entry door at rear on port. Two freight compartments with total capacity of 728 cub. ft. (20.6 m.³) below floor of main cabin. Other freight stowage dependent on passenger accommodation. On Models 649 and 749 additional freight, etc., can be carried in an all-metal pannier, known as a "Speedpak," 33 ft. long × 7 ft. wide × 3 ft. deep (10.05 × 2.13 × 0.9 m.) and weighing 1,800 lb. (817 kg.). This is carried under and closely fits the contour of fuselage. The "Speedpak" has capacity of 400 cub. ft. (11.32 m.³) and a stowage allowance of 8,200 lb. (3,723 kg.). Built-in electric hoists lowers "Speedpak" to ground for loading or unloading. "Speedpak" reduces speed by about 12 m.p.h. (19.2 km.h.).

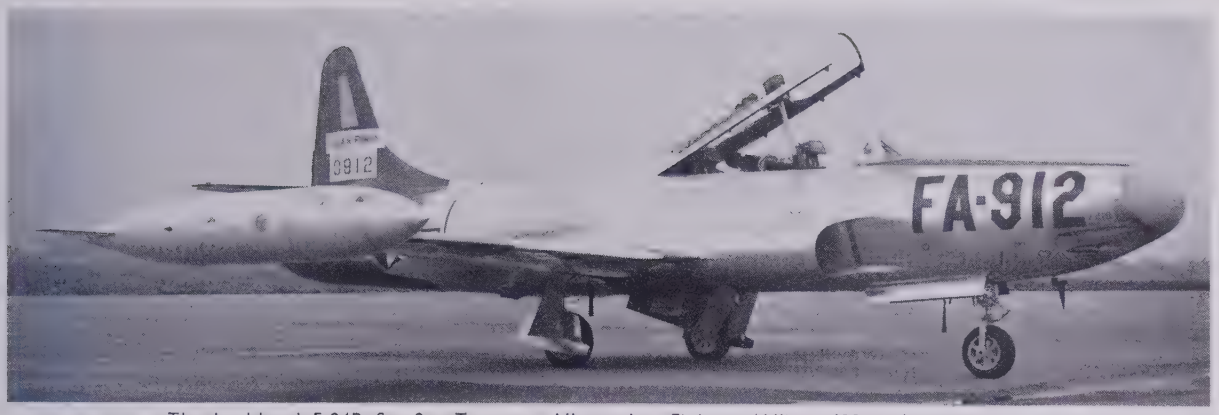
DIMENSIONS.—
- Span 123 ft. 0 in. (37.49 m.).
- Length 113 ft. 7 in. (34.65 m.).
- Height over fuselage 18 ft. 10 in. (5.73 m.).
- Height overall 24 ft. 9 in. (7.56 m.).

WEIGHTS AND LOADINGS (Model 1049).—
- Weight empty (including crew and all passenger equipment) approx. 69,000 lb. (31,326 kg.) depending on interior arrangements.
- Payload (approximate) 22,500 lb. (10,215 kg.).
- Max. take-off loaded weight 120,000 lb. (54,480 kg.).
- Max. landing weight 98,500 lb. (44,720 kg.)
- Wing loading (at max. take-off weight) 72.5 lb./sq. ft. (353.8 kg./m.²).
- Power loading (at max. take-off weight, take-off h.p.) 11.1 lb./h.p. (5.03 kg./h.p.).

PERFORMANCE (Model 1049).—
- Max. speed (fully loaded) over 330 m.p.h. (528 km.h.).
- Max. cruising speed at 65% power, 327 m.p.h. (523 km.h.).
- Landing speed 95 m.p.h. (152 km.h.).
- Service ceiling over 22,000 ft. (6,710 m.).
- Three-engine ceiling, over 17,000 ft. (5,185 m.).
- Two-engine ceiling over 8,000 ft. (2,440 m.).
- Normal range 2,450 miles (3,920 km.).
- Max. range 5,150 miles (8,560 km.).
- Take-off run at sea level with full load, 825 yds. (755 m.).
- Take-off distance to 50 ft. (15 m.) with full load, 2,050 yds. (1,873 m.).
- Landing distance from 50 ft. (15 m.) at max. landing weight 864 yds. (788 m.).



The Lockheed R7V-1 Naval Transport (four 3,250 h.p. Wright R-3350 Turbo-Cyclone engines).



The Lockheed F-94B Starfire Two-seat All-weather Fighter (Allison J33 turbojet engine).



The Lockheed F-94C Starfire Two-seat All-weather Fighter with the latest pointed nose radome.

THE LOCKHEED F-104.

Lockheed has received a development contract for a new supersonic light-weight fighter to be designated F-104. No authentic details of this aircraft have been released for publication.

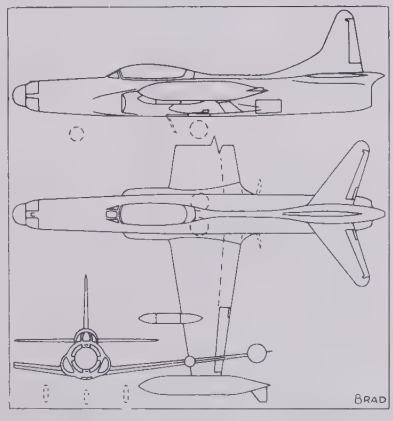
THE LOCKHEED STARFIRE.

U.S.A.F. designation: F-94.

The F-94 two-seat All-weather Fighter is a development of the F-80 Shooting Star. It was evolved from the two-seat T-33 trainer and originally used many of the main components and the production facilities of its predecessor. Later versions incorporate much original development.

The structure of the F-94 is generally similar to that of the F-80.

F-94A. Two-seat All-weather Fighter version of T-33 with radar operator replacing pupil pilot in second tandem seat, plus 940 lb. (426 kg.) of radar equipment. Allison J33-A-33 turbojet engine with Solar afterburner. Wings, landing-gear and centre fuselage same as for T-33. New nose and rear fuselage sections, former to house radar, latter to accommodate after-burner installation. All hydraulic electric and control systems similar to those of the F-80C. The prototype was a converted T-33.



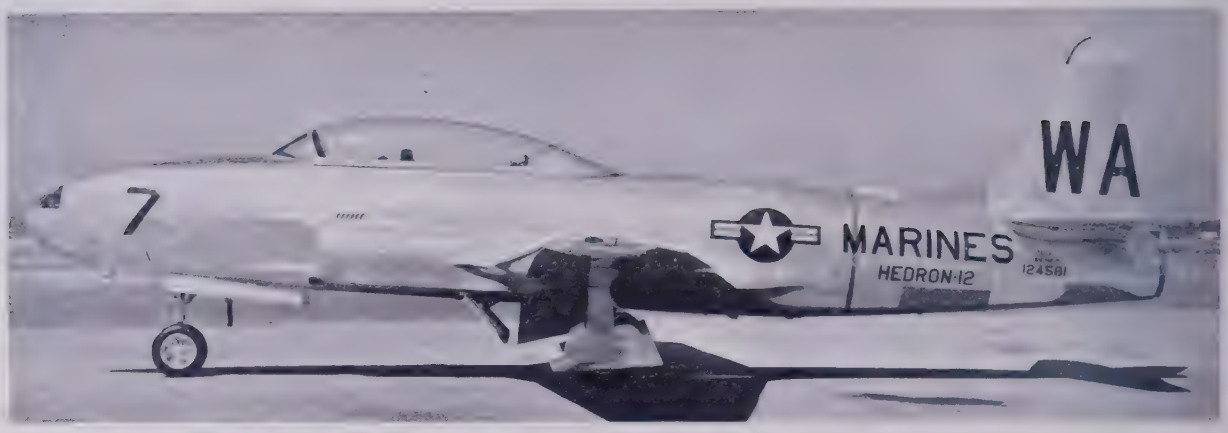
The Lockheed F-94C Starfire.

F-94B. Development of F-94A with improved electronic and operational equipment. Square wing-tips with centrally-mounted Fletcher tip tanks of greater capacity (230 U.S. gals.=870 litres each) and improved shape.

F-94C. Pratt & Whitney J48-P-5 engine with afterburner (6,250 lb.= 2,840 kg. s.t. without afterburner). Thinner wings, longer nose, swept horizontal tail surfaces and larger vertical surfaces. All-rocket armament comprising 48×2.75 in. rockets, 24 housed in a ring of firing tubes around the nose, and a further 24 rockets in two cylindrical pods, one on each wing midway between root and tip. Fibreglass noses to pods disintegrate in split second before rockets leave container by gas pressure generated by rockets themselves. The 9 ft. 6 in. (2.89 m.) pods extend about 6 ft. (1.83 m.) from wing leading-edge. 1,200 lb. of electronic equipment, including automatic



The Lockheed F-49C Starfire Two-seat All-weather Fighter (Pratt & Whitney J48 turbojet engine). (*Gordon Williams*).



The Lockheed TO-2 Two-seat Trainer (Allison J33 turbojet engine). (*Warren Bodie*).

locating, tracking and firing instruments, Westinghouse auto-pilot, Sperry Zero-Reader, ILS, etc.

DIMENSIONS (F-94B).—
Span 37 ft. 6 in. (11.44 m.).
Length 40 ft. 1 in. (12.23 m.).
Height 12 ft. 8 in. (3.86 m.).

DIMENSIONS (F-94C).
Span 37 ft. 4 in. (11.38 m.).
Length 44 ft. 6 in. (13.57 m.).
Height 14 ft. 11 in. (4.54 m.).

WEIGHT (F-94B).—
Weight loaded over 15,000 lb. (6,810 kg.).

WEIGHT (F-94C).—
Weight loaded over 20,000 lb. (9,080 kg.).

PERFORMANCE.—
No data available.

THE LOCKHEED SHOOTING STAR.
U.S. Air Force designations: F-80 and T-33.
U.S. Navy designation: TV.

The F-80 Shooting Star is now out of production but the T-33 two-seat trainer, which is the standard, and only, jet trainer in the U.S.A.F., U.S. Navy, U.S. Marine Corps and the air forces of nine allied nations, is still in production.

The following are the two principal versions of the two-seat trainer :—

T-33A. Two-seat trainer version of the F-80 with the Allison J33-A-35 engine. Fuselage lengthened by 38.6 in. (98.1 cm.), 26.6 in. forward of wings and 12 in. aft. to accommodate extra seat. Both seats under a continuous canopy hinged at rear edge and raised electrically or manually from either inside or outside aircraft. Smaller fuselage fuel tank (95 U.S. gals.=360 litres) and larger wing tanks, which are nylon cells instead of self-sealing type. Instructor in rear seat. Armament: two .50-in. machine-guns. In service in U.S.A.F. and Canada and supplied to nine allied nations under M.D.A.P. Built under licence by Canadair, Ltd. Canadian production aircraft powered by Rolls-Royce Nene engines.

TV-2 (formerly TO-2). U.S. Navy version of the T-33 two-seat trainer.

A full structural description of the Shooting Star has appeared in previous editions of "All the World's Aircraft."

DIMENSIONS (T-33A).—
Span 38 ft. 10½ in. (11.85 m.).
Length 37 ft. 9 in. (11.49 m.).
Height 11 ft. 4 in. (3.45 m.).

WEIGHTS (T-33A). –
Weight empty 8,084 lb. (3,670 kg.).
Weight loaded 11,965 lb. (5,432 kg.).

PERFORMANCE (T-33A).
Max. speed at S/L. 600 m.p.h. (960 km.h.).
Max. speed at 25,000 ft. (7,620 m.) 543 m.p.h. (874 km.h.).
Stalling speed (with flaps) 102 m.p.h. (164 km.h.).
Stalling speed (without flaps) 113 m.p.h. (182 km.h.).
Climb to 25,000 ft. (7,620 m.) 6.5 min.
Service ceiling 47,500 ft. (14,480 m.).
T.O. distance to 50 ft. (15.25 m.) (with water injection) 2,560 ft. (780 m.).
Landing distance from 50 ft. (15.25 m.) 3,480 ft. (1,061 m.).
Endurance 3.12 hours.



The Lockheed T-33A Two-seat Trainer (Allison J33 turbojet engine).

THE LOCKHEED MODEL 26 NEPTUNE.
U.S. Navy designation : P2V.

The P2V Neptune is in service in the U.S. Navy, the Royal Air Force and the Royal Australian Air Force.

The principal versions of the Neptune are :—

P2V-1. Two Wright R-3350-8 engines each with normal rated power of 2,100 h.p. and with 2,300 h.p. for take-off, driving Hamilton Standard four-blade airscrews with alcohol de-icing. Short nose with armament of two flexible .5-in. (12.7 mm.) machine-guns. Dorsal and tail turrets each armed with two .5-in. (12.7 mm.) guns.

Between September 29 and October 1, 1946, the third production P2V-1, suitably modified, set up a World's Record for Distance in a Straight Line by flying non-stop from Perth, Western Australia, to Columbus, Ohio, U.S.A., a distance of 11,235 miles (17,976 km.). Flight time was 55 hours 17 min.

The aircraft took off at a loaded weight of 85,000 lbs. (38,600 kg.) of which 50,400 lbs. (22,890 kg.) was gasoline, the fuel load alone representing about one and a half times the empty weight of the aircraft. Jato was used for take-off.

P2V-2. Two Wright R-3350-24W engines, each with take-off output of 2,500 h.p. (dry) or 2,800 h.p. (wet) and normal continuous rating of 2,100 h.p. Hamilton Standard three-blade airscrews with paddle blades and electric de-icing. Combustion type heaters for wing and tail de-icing. Longer nose (2½ ft.=0.76 m. longer than P2V-1) with additional search and tactical radar equipment. Nose armament increased to six 20 mm. cannon, fired by pilot. Dorsal turret armed with two .50-in. machine-guns and tail turret with two 20 mm. cannon. Other war stores as for P2V-1.



A Lockheed P2V-5 Neptune with the latest form of radar anti-submarine detection gear in place of the rear turret. (*Warren Bodie*).



The Lockheed P2V-5 Neptune Naval Patrol Bomber (two 3,250 h.p. Wright R-3350 Turbo-Cyclone engines).
(*Harold Martin*).

P2V-3. Two Wright R-3350-26WA engines each with a take-off output of 2,610 h.p. (dry) or 3,090 h.p. (wet) and a normal continuous rating of 2,300 h.p. P2V-3W is a special search and early warning radar version.

P2V-4. Two Wright R-3350-30W Turbo-Cyclone compounded engines each developing 3,250 h.p. for take-off (dry). Fitted with new anti-submarine detection equipment, including improved radar search apparatus with large external radome beneath fuselage, magnetic detection gear, etc. Increased wing tankage permits increased range and releases space in fuselage for additional armament and electronic devices.

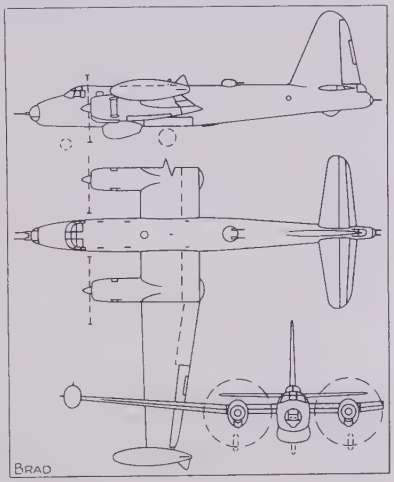
P2V-5. Development of P2V-4. Has flexible nose gun turret armed with two 20 mm. cannon in place of the previous fixed nose armament. Larger wing-tip tanks carrying radar and searchlight as well as extra fuel. Considerably more internal radar and electronic equipment. Also supplied to the Royal Air Force and Royal Australian Air Force. R.A.F. version known as Neptune M.R. Mk. 1.

P2V-6. Similar to P2V-5 but specially equipped for mine-laying and anti-submarine warfare. Longer nose to give added room for forward crew and improved access to equipment, smaller wing-tip tanks and smaller radome. New features include stainless steel engine nacelles and pressure fuelling. Interchangeability for mine-laying and anti-submarine work permits a wide selection of armament. Appearance of P2V-6 will vary with different types of missions.

The following description refers to the P2V-3.

Type.—Twin-engined Naval Patrol Bomber.

Wings.—All-metal cantilever mid-wing monoplane. Aerofoil section NACA 2419 modified with max. thickness at 38% of chord. Wing designed to give temporary flotation in event of ditching. Centre-section wing box continuous through fuselage and entire bomb-bay load carried directly by wing. All-metal ailerons with controllable trim-tab in each. Lockheed-Fowler flaps on circular arc racks inboard of ailerons. Max. flap depression 32°. Ailerons also droop 10° when flaps lowered. Internal aerodynamic balances on all control surfaces. Heated leading-edge de-icing. Gross wing area 1,000 sq. ft. (92.9 m.²).



The Lockheed P2V-5 Neptune.

Fuselage.—All-metal semi-monocoque structure.

Tail Unit.—Cantilever monoplane type, with metal covering over all surfaces. Tail-unit incorporates "Varicam" (variable camber), a movable trimming surface between fixed tail and elevator which is operated by electrically-driven irreversible screw-jack. Tail-plane and fin have detachable thermally-heated leading-edges. Vertical fin area 17% of wing area. Balanced control surfaces, with trim-tab in each elevator. Trim-balance tabs in rudder. Elevator area (each) 39.3 sq. ft. (3.65 m.²). Rudder area 38.4 sq. ft. (3.57 m.²).

Landing Gear.—Retractable tricycle type. Hydraulic brakes on main wheels.

Power Plant.—Two Wright R-3350-26WA eighteen-cylinder two-row radial air-cooled engines. Hamilton Standard Hydromatic three-blade constant-speed airscrews, 15 ft. 2 in. (4.62 m.) diameter. Self-sealing fuel-tanks with nylon plastic casing. Normal fuel capacity 2,200 U.S. gallons (8,316 litres). Provision for 700 U.S gallon (2,646 litres) ferrying tank in bomb-bay. Dural armour in nacelles.

Accommodation.—Crew of seven: pilot, co-pilot, navigator/bombardier (who handles radar bombing gear), radar operator, and dorsal and rear gunners. All positions armoured. Galley and sleeping accommodation.

Armament.—Up to six 20 mm. forward-firing cannon in nose; two .5-in. (12.7 mm.) flexible machine-guns in dorsal turret; and two flexible 20 mm. cannon in power-operated tail-turret. Provision for sixteen 5-in. (12.7 cm.) rocket projectiles under wings. Bomb-load of 8,000 lb. (3,629 kg.) carried internally may consist of sixteen 500 lb. (227 kg.), eight 1,000 lb. (454 kg.) or four 2,000 lb. (907 kg.) bombs, two 2,165 lb. (982 kg.) torpedoes, or 2,000 lb. (907 kg.) sea-mines, or twelve 325 lb.



The Lockheed P2V-6 Neptune (two 3,250 h.p. Wright R-3350 Turbo-Cyclone engines).

(147 kg.) depth-charges. Sonobuoy installation.
DIMENSIONS.
Span 100 ft. 0 in. (30.48 m.).
Length 76 ft. 10 in. (23.43 m.).
Height (over rudder) 28 ft. 1 in. (8.5 m.).
WEIGHTS (P2V-3).—
Weight empty 34,683 lb. (15,746 kg.).
Disposable load 23,317 lb. (10,586 kg.).
Max. take-off weight 58,000 lb. (26,300 kg.).
Landing weight 54,000 lb. (24,520 kg.).
PERFORMANCE (P2V-3).—
Max. speed 288 m.p.h. (461 km.h.) at 12,600 ft. (3,840 m.).
Stalling speed (power on) 77 m.p.h. (123.2 km.h.).
Initial rate of climb (T.O. weight) 2,086 ft. min. (636 m./min.).
Service ceiling 27,100 ft. (8,265 m.).
Range 3,560 miles (5,696 km.) at 180 m.p.h. (288 km.h.) at 1,500 ft. (460 m.).
T.O. distance to clear 50 ft. (15.25 m) (T.O. weight and power) 947 yds. (866 m.).

McCULLOCH

McCULLOCH MOTORS CORPORATION, AIRCRAFT DIVISION.

OFFICE AND WORKS: 9775, AIRPORT BOULEVARD, LOS ANGELES 45, CAL.

President: Robert P. McCulloch.
General Manager: Russell E. Gage.
Chief Engineer: R. A. Wagner.
Factory Superintendent: Claire G. Crosier.
Design Consultants: D. K. Jovanovich and F. J. Kozloski.

The Aircraft Division of McCulloch Motors Corpn. is located in separate facilities for helicopter construction in the immediate vicinity of the main plant. Here all rotary-wing administration, experimental and production work are accomplished.

The first McCulloch helicopter, the MC-4, made its first flight on March 20, 1951, and an Approved Type Certificate (6H3) was issued to the MC-4 on February 17, 1953. The MC-4 is the first tandem rotor helicopter to be certificated by the C.A.A.



The McCulloch MC-4C Helicopter (200 h.p. Franklin engine).

THE McCULLOCH MC-4C.

U.S.A.F. designation: YH-30.

TYPE.—Two-seat Tandem-rotored Helicopter.
ROTOR SYSTEM.—Two tandem three-blade intermeshing rotors. Rotor diameter 33 ft. (7.01 m.). Horizontal drive shaft through upper fuselage, rotors being driven through two right-angle reduction gear units mounted in aluminium-alloy housing beneath each rotor. Gear reduction 4.44 : 1. Rotor blades are of all-metal construction, each blade consisting of a leading-edge extrusion and a formed aluminium skin which are bonded together by a thermo-setting elastic resin.
FUSELAGE.—Welded steel tube framework covered with light metal skin.
LANDING GEAR.—Fixed nose-wheel type. Oleo shock-absorbers. Full swivelling nose-wheel. Provision for skid gear.
POWER PLANT.—One 200 h.p. Franklin 6A4-200-C6 six-cylinder horizontally-opposed air-cooled engine mounted horizontally amidships and driving main horizontal drive shaft through a twelve-unit vee-belt system. Simple idler pulley engages drive for flight. Gravity fuel system. Fuel capacity 30 U.S. gallons (114 litres.).
ACCOMMODATION.—Enclosed cabin in nose seating two side-by-side with dual controls.
DIMENSIONS.—
Overall width (rotor diameter) 23 ft. (7.01 m.).
Overall length 32 ft. 5 in. (9.88 m.).
Overall height 9 ft. 3 in. (2.82 m.).
WEIGHTS.—
Weight empty 1,600 lb. (726 kg.).
Disposable load 700 lb. (318 kg.)
Weight loaded 2,300 lb. (1,044 kg.).
PERFORMANCE (Estimated).
Max. speed at S/L. 105 m.p.h. (168 km.h.).
Operating speed (75% power) at S.L. 85 m.p.h. (136 km.h.).
Max. rate of climb 1,000 ft./min. (305 m./min.).
Hovering ceiling 6,000 ft. (1,830 m.).
Service ceiling 10,000 ft. (3,050 m.).
Range at 75 m.p.h. (120 km.h.) 200 miles (320 km.).

McDONNELL

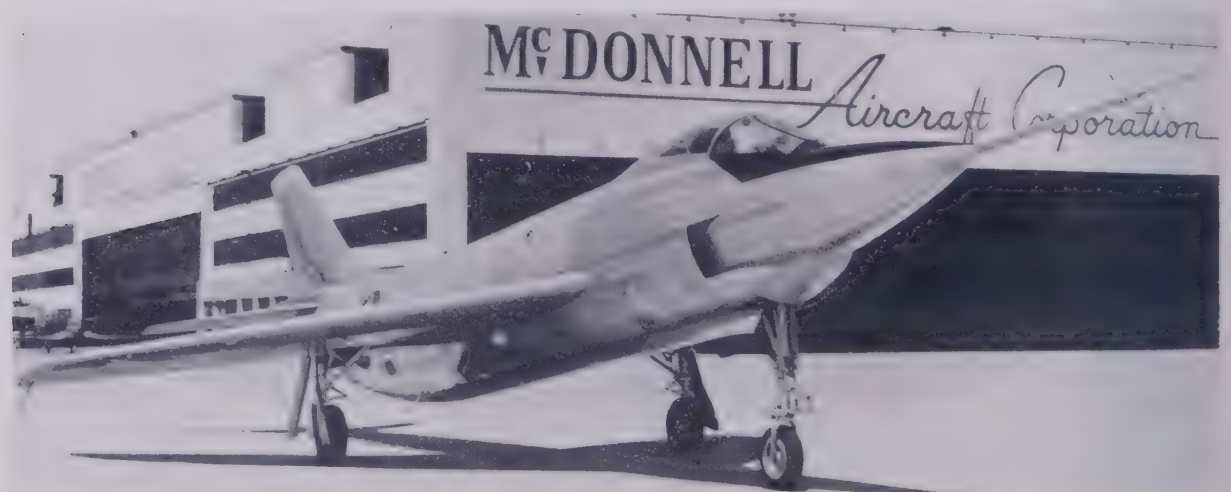
McDONNELL AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: ST. LOUIS 3, MISSOURI.

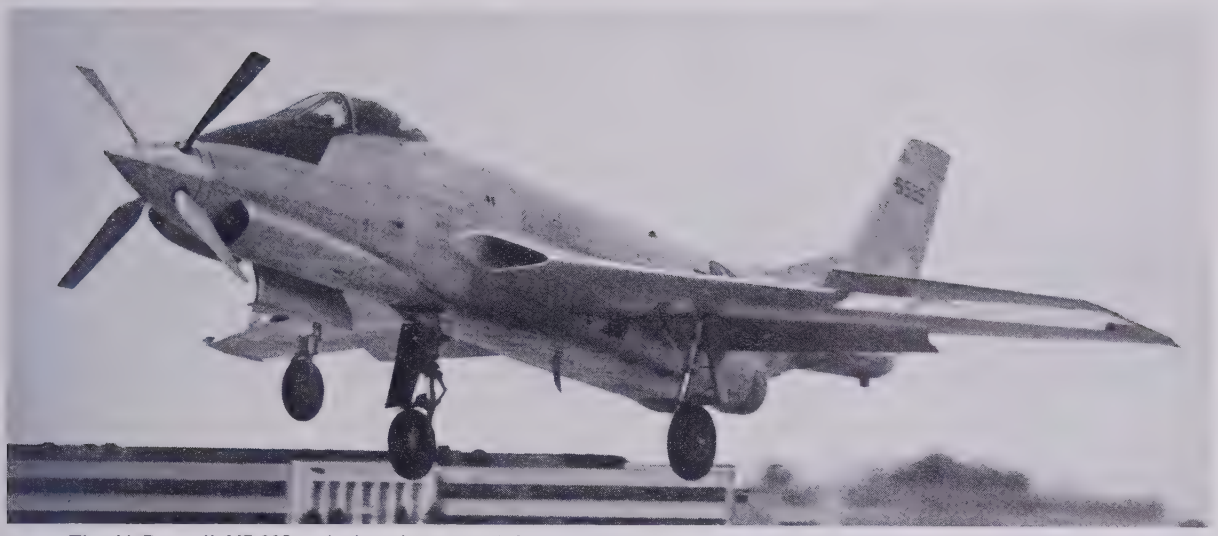
President and Chairman of the Board: J. S. McDonnell, Jr.
Vice-President, Manufacturing: C. Warren Drake.
Vice-President, Engineering: Kendall Perkins.
Vice-President, Aircraft Engineering: G. C. Covington.
Vice-President, Contracts: R. H. Charles.
Vice-President, Personnel and Public Relations: W. R. Orthwein, Jr.
Vice-President, Sales and Service: J. F. Aldridge.
Vice-President, Eastern Representative: L. E. Williams.
Chief Engineer, Helicopters: C. H. Hurcamp.
Chief Engineer, Missiles: B. G. Bromberg.
Secretary: Thomas G. Rutledge.
Treasurer: J. H. Cinnater.

The McDonnell Aircraft Corporation was incorporated on July 6, 1939. Since that date the activities of the company have been devoted exclusively to the development and production of aircraft for the U.S. Government.

The first aircraft of McDonnell design to go into production for the U.S. Navy was the FH-1 Phantom twin-jet fighter and this was followed by the F2H-1



The prototype McDonnell XF3H-1 Demon Single-seat Fighter (Westinghouse J40 turbojet engine).



The McDonnell XF-88B, which is being used for supersonic propeller research. Its normal power-plant consists of two Westinghouse J34 turbojets, the turboprop engine being used solely for propeller research.

Banshee, which went into production in 1947. The Banshee in successively developed forms has since been in continuous production for the U.S. Navy.

The latest U.S. Navy fighter of McDonnell design is the F3H Demon, a swept-wing carrier fighter, the prototype of which flew for the first time on August 7, 1951. The Demon has been ordered into production by both McDonnell and the Temco Aircraft Corporation.

For the U.S. Air Force McDonnell is building the F-101 Voodoo long-range twin-jet swept-wing escort fighter.

McDonnell has also been engaged in helicopter development since 1944.

In 1951, McDonnell was successful in three helicopter competitions. These are for a cargo transporter or "flying crane" (XCH-1), an assault transport helicopter (XHRH-1) and a convertiplane (XL-25). Detailed information on these aircraft as well as on the company's work in the field of guided missiles is classified.

THE McDONNELL VOODOO.

U.S. Air Force designations: F-101 and RF-101.

The original XF-88 and XF-88A swept-wing twin-jet fighters, the latter with afterburners, underwent successful evaluation by the U.S.A.F. in 1949 and 1950, but owing to a cut-back in defense funds and a change in tactical requirements, the experimental contract was terminated in August, 1950.

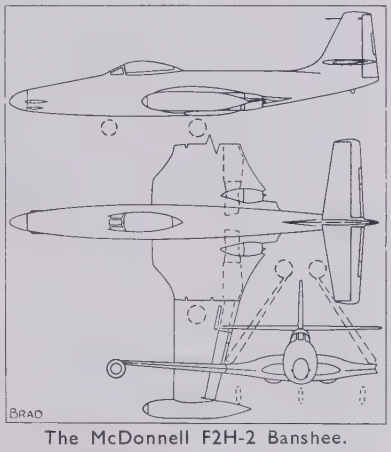
After a period of over a year the XF-88A was revived and, with modifications, has now been ordered into production as a long-range escort fighter under the designation F-101. A photographic-reconnaissance version known as the RF-101 has also been ordered. Both the F-101 and RF-101 will be powered by the Pratt & Whitney J57 turbojet engine.

No details of the aircraft in its developed form are available for publication.

THE McDONNELL XF-88B.

One of the two prototypes of the XF-88 has been fitted with an Allison XT38 turboprop engine, in addition to its two Westinghouse J34 turbojets, to serve as a test vehicle for conducting a research programme in the field of supersonic type airscrews. Extensive tests will be made with this aircraft using Curtiss Electric, Hamilton Standard and Aeroproducts supersonic airscrews of 4 ft., 7 ft. and 10 ft. diameters and of two, three and four-blade configurations. A series of engine gear-boxes will provide three different ratios for engine/airscrew speeds.

This aircraft, the XF-88B, which made its first flight on April 14, 1953, is illustrated above.



The McDonnell F2H-2 Banshee.

THE McDONNELL DEMON.

U.S. Navy designation: F3H.

The Demon is a single-seat single-jet swept-wing carrier-based fighter which is going into production for the U.S. Navy. The prototype XF3H-1 made its maiden flight on August 7, 1951. The Demon, the general arrangement of which can be seen from the photograph on the previous page, is powered in its prototype form with a Westinghouse J40 turbojet engine. The production Demon will be fitted with the Allison J71 engine. No other details are available for publication.

The production F3H-3 is being built by both McDonnell and the Temco Aircraft Corporation of Dallas, Texas.

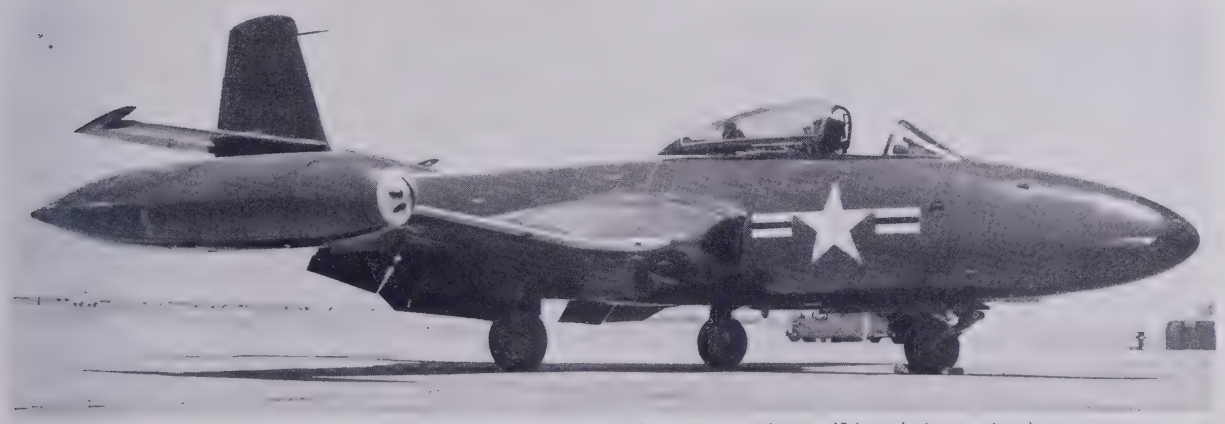
THE McDONNELL BANSHEE.

U.S. Navy designation : F2H.

The original contract for the design and construction of the XF2H-1 was placed by the U.S. Navy in March, 1945. The first prototype flew on January 11, 1947, and the first production order for the F2H-1 was placed in May, 1947.

F2H-1. Two Westinghouse J34-WE-22 (3,000 lb.=1,360 kg. s.t.) engines. First production model, the first example of which flew for the first time on August 10, 1949. Fifty-six built.

F2H-2. Two Westinghouse J34-WE-34 (3,150 lb.=1,430 kg. s.t.) engines. Fuselage lengthened 12 in. forward of wings to accommodate an additional 177 U.S. gallon (670 litre) internal fuel tank and two 200 U.S. gallon (756 litre)



The McDonnell F2H-2 Banshee Naval Fighter (two Westinghouse J34 turbojet engines).



The McDonnell F2H-2P Banshee Photographic Reconnaissance Monoplane. (*Peter Bowers*).

wing-tip tanks added. First of an order for 188 was flown in August, 1949. Second contract for 146 placed in September, 1949, completed in April, 1952. All F2H-2's modified for "probe-drogue" flight refuelling.

F2H-2N. Night fighter version of F2H-2. Longer nose to accommodate both armament and A.I. radar. Last of 14 delivered to U.S. Navy in June, 1951.

F2H-2P. Photographic reconnaissance version of F2H-2. New and longer heated nose can accommodate six different types of camera. Combination view-finder provides pilot with unobstructed view of terrain below and ahead. Orientation and operation of all cameras under pilot's control. Last of 58 delivered to U.S. Navy in August, 1952.

F2H-3. Long-range all-weather fighter version. Extra section inserted in mid-fuselage to accommodate two additional fuel tanks. Search radar in nose with cannon armament further aft in fuselage sides. New tailplane with slight dihedral Fitted with "probe-drogue" flight-refuelling equipment. First of an order for 175 F2H-3's delivered to U.S. Navy in March, 1952.

The description below refers in the main to the F2H-2.

TYPE.—Single-seat Jet-propelled Fighter.

WINGS.—Cantilever low-wing monoplane. Modified laminar flow aerofoil section. Aluminium-alloy structure with flush-riveted skin and high gloss finish, in three main sections, consisting of centre-section and two outer sections, the latter folding upwards for carrier stowage. Electrical folding gear controlled from cockpit. All-metal ailerons with trim and balance tabs in each. Electrically-operated split trailing-edge flaps in six sections extend under fuselage between ailerons. Electrically-operated drag brakes in each outer wing.

FUSELAGE.—Monocoque structure of aluminium-alloy with flush-riveted metal skin.

TAIL UNIT.—Monoplane type. Cantilever fin and dihedral tailplane. All-metal statically-balanced rudder and elevators with controllable trim and balance tabs.

LANDING GEAR.—Retractable nose-wheel type. Electrical retraction. Provision for nose-wheel dolly to provide more compact tail-up carrier stowage. Pneumatically-operated deck arresting-hook below rear fuselage. Provision for catapult launch.

POWER PLANT.—Two Westinghouse J34-WE-34 axial-flow turbojet engines (3,600 lb.=1,635 kg. s.t. each) mounted in wing roots alongside the fuselage and exhausting aft of the trailing-edge of the wing. Air-intakes in leading-edge of centre-section. Main fuel in three (F2H-2) or five (F2H-3) self-sealing fuselage tanks. Two 200 U.S. gallon (756 litre) wing-tip tanks. F2H-2 and F2H-3 have "probe-drogue" in-flight refuelling equipment.

ACCOMMODATION.—Pressurized and air-conditioned pilot's cockpit. Bullet-proof electrically-heated windshield. Plexiglas bubble canopy slides backwards for access, and may be jettisoned in an emergency by explosive charge. Pilot ejection seat.

ARMAMENT.—Four 20 mm. cannon (160 r.p.g.) in lower nose.

DIMENSIONS.—
Span 41 ft 7.4 in (12.68 m.).
Width folded 18 ft. 5½ in. (5.60 m.).
Length 40 ft. 2 in. (12.24 m.).
Height (over tail) 14 ft. 5½ in. (4.40 m.).
Height over tail in kneeling position 16 ft. 9 in. (5.10 m.).
Height (over folded wings) 14 ft. 9 in. (4.5 m.).
Max. height during wing folding 16 ft. 6½ in. (5.03 m.).

WEIGHTS.—
Max. combat weight 14,000 lb. (6,356 kg.).



The McDonnell F2H-3 Banshee Naval Fighter.

Max. overloaded weight 17,000 lb. (7,720 kg.).

PERFORMANCE.—
Max. speed about 600 m.p.h. (960 km.h.).
Speed at critical height 575 m.p.h. (920 km.h.).
Rate of climb 9,000 ft./min. (2,745 m./min.).
Ceiling 56,000 ft. (17,080 m.).
Tactical radius of action 600 miles (960 km.).
Ferry range with tip tanks 2,250 miles (3,600 km.).



The McDonnell F2H-3 Banshee Naval Fighter (two Westinghouse J34 turbojet engines).

THE McDONNELL MODEL 78.
U.S. Navy designation: XHRH-1.

The XHRH-1 is a large jet-propelled Assault Transport helicopter which is being developed for the U.S. Marine Corps under an experimental contract awarded to McDonnell in June, 1951. No details are available.

THE McDONNELL MODEL 82.
U.S. Air Force designation: XL-25.

The XL-25 is a convertiplane which is being developed for the U.S. Air Force under an experimental contract received in June, 1951. Its designation reveals that it is intended for liaison duties, but no further details are available for publication.

THE McDONNELL MODEL 86.
U.S. Navy designation: XCH-1.

The XCH-1 now being developed for the U.S. Navy is a "flying crane" or cargo transporter for short-range work, such as ship-to-shore transfer of heavy equipment, etc. It will have a power winch and retractable cargo sling to lift and carry heavy cargo and will also be able to handle cargo "pods." It is understood that the large folding three-blade rotor will be powered with McDonnell turbojets, one at each rotor-blade tip. No other details are available for publication.

McKINNIE

McKINNIE AIRCRAFT COMPANY, INC.

HEAD OFFICE AND WORKS: P.O. Box 11, FARGO, NORTH DAKOTA.

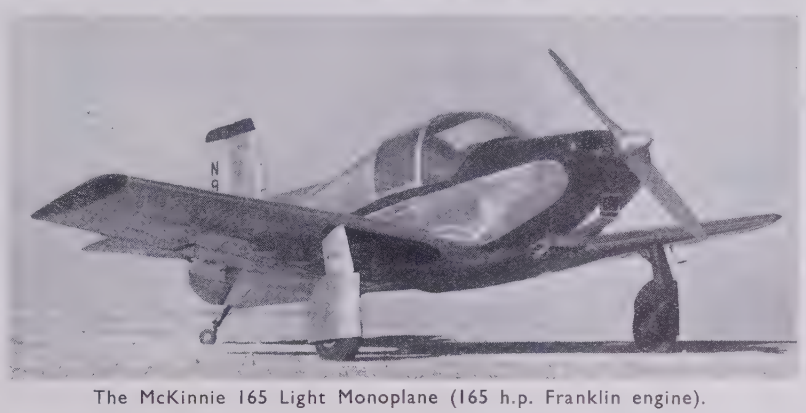
President and Chief Engineer: James McKinnie.

Vice-President: William McKinnie.

Secretary: A. I. Johnson.

McKinnie Aircraft Co., Inc. was formed in 1947 in order to develop a new and simplified method of airframe design, and construction. The building of its first all-metal aircraft, the McKinnie 165, was completed in July, 1952, and the aircraft made its first flight on August 10, 1952.

The McKinnie 165 is a two-seat all-metal light monoplane of the executive type but it can also be adapted as a light military trainer. It is stressed for full aerobatics.



The McKinnie 165 Light Monoplane (165 h.p. Franklin engine).

THE McKINNIE 165.

TYPE.—Two-seat Light monoplane.

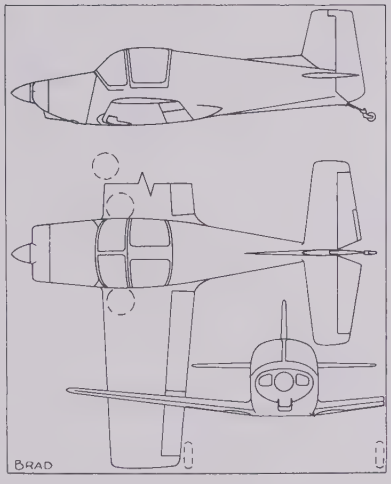
WINGS.—Low-wing cantilever monoplane. Wing section NACA 2415 (root), NACA 2412 (tip). Aspect ratio 5.3. Chord 5 ft. (1.55 m.) at root, 3 ft. 10 in. (1.16 m.) at tip. Dihedral 7°. Incidence 3° at root, 0° at tip. All-metal structure. Spars and ribs made up from .064 gauge, and skin from .051 gauge 24ST Alclad sheet. Trailing-edge flaps and plain ailerons fabricated from .032 gauge sheet. Total flap area 13.2 sq. ft. (1.22 m.²). Total aileron area 7.5 sq. ft. (0.69 m.²). Gross wing area 106 sq. ft. (9.85 m.²).

FUSELAGE.—All-metal structure. Forward section a semi-monocoque, the rear section a full monocoque. Bulkheads of .064 gauge and skin of .051 gauge Alclad sheet.

TAIL UNIT.—Cantilever monoplane type. All surfaces fabricated from .040 gauge Alclad sheet. Areas: fin 7.5 sq. ft. (0.69 m.²), rudder 4.5 sq. ft. (0.42 m.²), tailplane 11.6 sq. ft. (1.07 m.²), elevators (total) 10.0 sq. ft. (0.93 m.²). Tailplane span 9 ft. 10 in. (2.9 m.).

LANDING GEAR.—Retractable tail-wheel type. Electrical retraction. Firestone rubber/sprung knee-action shock-absorber legs. Firestone cast magnesium wheels with 6.00 × 6 tyres and Firestone hydraulic single-disc brakes. Wheel track 10 ft. 3 in. (3.13 m.).

POWER PLANT.—One 165 h.p. Franklin 6A4-165-B3 six-cylinder horizontally-opposed air-cooled engine. Sensenich "Skyblade" two-blade selective-pitch airscrew 6 ft. 4 in. (1.93 m.) diameter. Four Goodyear Pliocel nylon fuel cells, two in each wing. Total fuel capacity 40 U.S. gallons (150 litres).



The McKinnie 165.

ACCOMMODATION.—Cabin seats two side-by-side with dual controls. Single-piece Lucite windshield. Entrance to cabin from either side through upward-hinging framed Lucite panels. Cabin interior 44 in. (112 cm.) wide. Baggage capacity 20 cub. ft. (0.56 m.³).

DIMENSIONS.—
Span 23 ft. 6 in. (7.16 m.).
Length 18 ft. 3 in. (5.56 m.).
Height 7 ft. 0 in. (2.13 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,200 lb. (545 kg.).
Crew (2) 340 lb. (154 kg.).
Fuel 240 lb. (119 kg.).
Baggage 60 lb. (27 kg.).
Weight loaded 1,840 lb. (835 kg.).
Wing loading 17.4 lb./sq. ft. (84.91 kg./m.²).
Power loading 11.1 lb./h.p. (5.04 kg./h.p.).

PERFORMANCE.—
Max. speed at S/L. 175 m.p.h. (280 km.h.).
Cruising speed at S/L. 160 m.p.h. (256 km.h.).
Cruising speed at 8,000 ft. (2,440 m.) 170 m.p.h. (272 km.h.).
Stalling speed (clean) 46 m.p.h. (73.6 km.h.).
Stalling speed (flaps down) 40 m.p.h. (64 km.h.).
Initial rate of climb 1,550 ft./min. (475 m./min.).
Service ceiling 18,000 ft. (5,490 m.).
Cruising range at 8,000 ft. (2,440 m.) 720 miles (1,150 km.).
Take-off run (no wind) 400 ft. (122 m.).
Take-off to clear 50 ft. (15.25 m.) (no wind) 650 ft. (198 m.).

MARTIN

THE GLENN L. MARTIN COMPANY.

HEAD OFFICE AND WORKS: MIDDLE RIVER, BALTIMORE 3, MARYLAND.

Established: 1909.

Chairman of the Board and President: George M. Bunker.

Vice-President, Operations: W. B. Bergen.

Vice-President, Procurement: G. B. Shaw.

Vice-President, Industrial Relations: D. W. Siemon.

Vice-President, Contracts: Jess W. Sweetser.

Vice-President, Engineering: E. G. Uhl.

Vice-President, Finance: J. B. Wharton, Jr.

Vice-President, Manufacturing: G. T. Willey.

Treasurer: W. L. Lucas.

Controller: E. R. Uhlig.

Secretary: F. S. Cross.

In 1952 the Glenn L. Martin company had settled down with a steady two-shift production pattern on two aircraft and began production on two others.

The fourth production contract for the P5M-1 Marlin anti-submarine flying-boat was announced in July and the existence of a second order for a substantial number of B-57A night intruder bombers for the the U.S.A.F. was revealed in October.

In October, 1952 the U.S. Navy announced that the Martin company had been awarded a contract to build a high-speed jet-powered seaplane of novel design to be known as the XP6M-1. Also disclosed in 1952 was the existence and first flight of the Martin Model 270, an experimental flying-boat featuring a new version of the P5M-1 hull with a 15 : 1 length-to-beam ratio.

In January, 1952 both Eastern Air Lines and Trans-World Airlines began the scheduled operation of Martin 4-0-4 airliners. The last of forty-one TWA 4-0-4's was delivered in September, 1952, and the last of EAL's sixty 4-0-4's were handed over early in 1953. Two 4-0-4's were also delivered to the U.S. Coast Guard.

In the special weapons field orders were received for guided missiles, rockets, turrets and electronic and related work. Details on these are, in the main, classified.

The company's employment level was relatively stable throughout the year with a total personnel numbering slightly over 20,000.

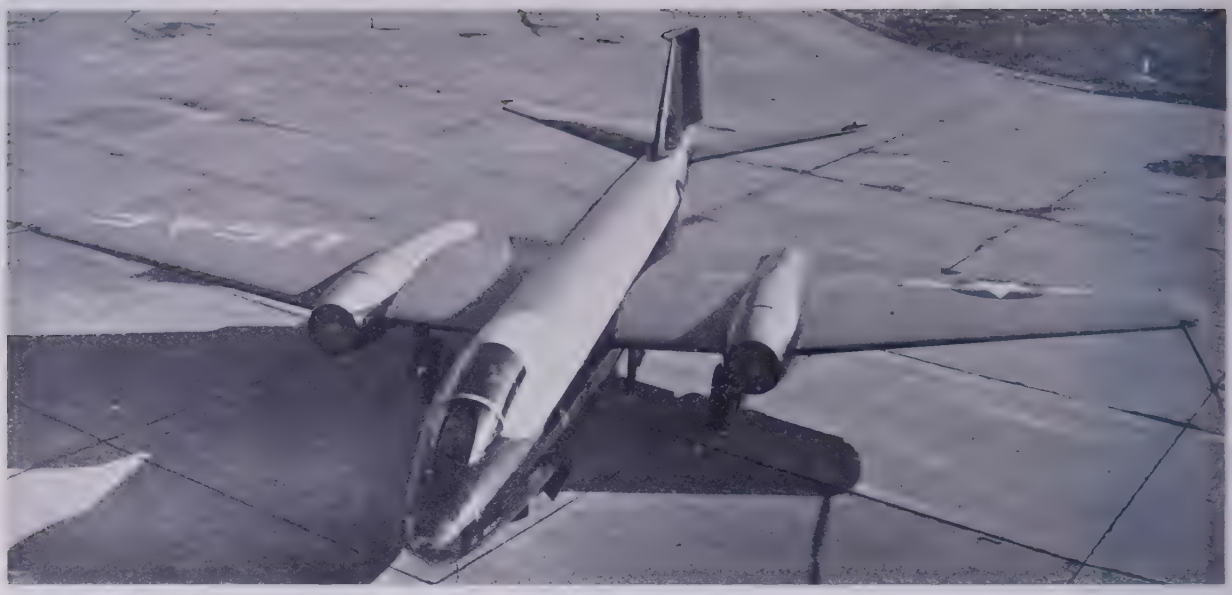
THE MARTIN CANBERRA.
U.S.A.F. designation: B-57A.

The Martin company is building under licence a substantial quantity of a night intruder bomber version of the English Electric Canberra for the U.S.A.F. The American version of the Canberra is powered by two Wright J65 Sapphire turbojet engines.

In order to convert the Canberra to fulfil a night intruder rôle, as well as to adapt it to American production methods, a considerable amount of redesign has been undertaken by the Martin Company.

A Martin-developed feature introduced into the B-57A is a pre-loaded revolving bomb-bay door which rotates through 180 degrees just before the bombs are released, leaving no excrescences to reduce speed on the bombing run.

In the work of conversion and adaptation Martin engineers were guided by the needs to make the B-57A an effective weapon in its new rôle; to preserve the particular characteristics of the Canberra which make it so eminently suitable for this new duty; and to engineer the



A British-built Canberra, with cockpit and canopy modified by Martin, which was used for engineering study and flight familiarisation. during the development of the B-57A.

design so that it can be produced as inexpensively as possible compatible with its mission.

Two contracts, each for a substantial number of B-57A's, are held by the Martin company and production was well under way by the end of 1952.

The first production B-57A made its first flight on July 20, 1953.

THE MARTIN MODEL 275 SEAMASTER.

U.S. Navy designation: XP6M-1.

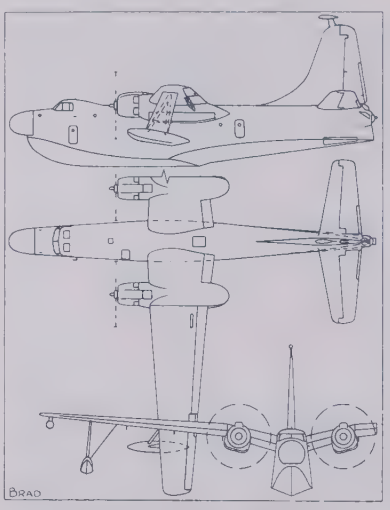
As the result of a design competition the U.S. Navy has awarded a contract to Martin to build a high-speed multi-jet-engined seaplane, which will carry the designation XP6M-1. It will be radically different in its concept and design from any other type of sea-going aircraft. No other details are available.

THE MARTIN MODEL 237 MARLIN.

U.S. Navy designation: P5M-1.

The P5M-1 is the first twin-engined flying-boat to be developed for the U.S. Navy since the war.

The most characteristic feature of the P5M-1 is the new hull design, which results from a long series of tests made, in co-operation with the Navy and the National Advisory Committee for Aeronautics, with models in the towing tank of the Stevens Institute of Technology.



The Martin P5M-1 Marlin.

From the shallow Vee step aft the hull is characterised by its depth and length. This long afterbody is designed to permit safer alightings on rough water without excessive pitching and bouncing, and to reduce normal take-off time and distance.

Hydroflaps are located near the hull stern post underwater. Operated hydraulically these flaps may be opened out, either independently or together, to a maximum angle of 65 degrees from the hull sides. In addition to reducing the turning radius, the hydro flaps may be used as water brakes for quicker stops in restricted areas.

The first experimental prototype to test the new hull design, later to become the XP5M-1, was a hybrid, the experimental hull being fitted with a set of PBM Mariner wings off the production



The Martin P5M-1 Marlin Flying-boat (two 3,250 h.p. Wright R-3350 Turbo-Cyclone engines).



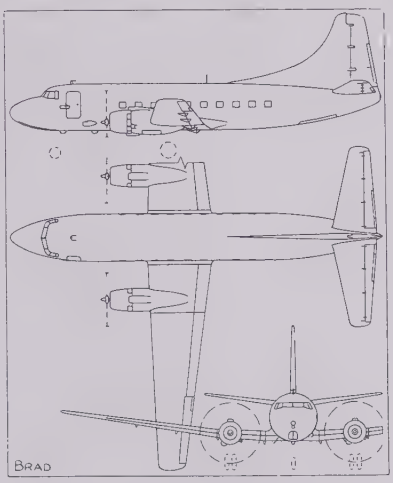
The Martin 4-0-4 Airliner (two 2,400 h.p. Pratt & Whitney R-2800-CB16 engines).

line. A single fin and rudder replaced the twin tail of the Mariner and Wright R-3350 engines were installed. Control power boost was added. The prototype was completed in the Summer of 1948 and tested by the U.S. Navy in 1949-50.

In the meantime proposals for a PBM Mariner replacement based on experience and test results obtained with the hybrid boat were submitted to and accepted by the U.S. Navy, but during the initial design stages the mission was changed from that of patrol to high-priority anti-submarine warfare.

Engineering for the production version was therefore directed towards producing the most potent ASW weapon. Fitted with the most powerful tactical radar in any U.S. aircraft, the P5M-1 Marlin, which carries a crew of seven, is equipped with the latest types of magnetic detection equipment, sonobuoys, searchlight, cameras for reconnaissance and damage-assessment, etc.

The gull wings and stabilising floats are similar to those of the PBM Mariner but the P5M-1 has a new single vertical tail surface. The power plant consists of two Wright R-3350 Turbo-Cyclone engines mounted in nacelles which, as with those of the PBM, have a bay beneath the wings for the stowage of bombs, mines, depth-charges, etc.



The Martin 4-0-4 Airliner.

Substantial orders for the P5M-1 have been received by the Martin company and production was started in January, 1951. An initial order has also been received for an Air/Sea Rescue version of the P5M-1 for the U.S. Coast Guard.

The first production P5M-1 flew for the first time on June 22, 1951, and the first Marlin joined the U.S. fleet in April, 1952.

DIMENSIONS.—
Span 118 ft. (36 m.).
Length 95 ft. (289 m.).
Height 35 ft. 2 in. (10.7 m.).
Wing area 1,406 sq. ft. (130.6 m.²).

WEIGHTS AND PERFORMANCE.—
No data available.

THE MARTIN 4-0-4.

U.S. Coast Guard designation: RM-1.

The 4-0-4 is the latest in the Series of Martin commercial transports and is a development of the 2-0-2. It is 39 in. (1.0 m.) longer than the 2-0-2 and is pressurised. C.A.A. type certification of the 4-0-4 was granted on October 5, 1951.

One hundred and three 4-0-4's were produced, sixty for Eastern Air Lines, forty-one for Trans-World Airlines and two for the U.S. Coast Guard. Deliveries began in the Autumn of 1951 and were completed early in 1953.

TYPE.—Twin-engined Airliner.

WINGS.—All-metal cantilever low-wing monoplane. GLM-W 16 laminar-flow aerofoil section. Martin ailerons with total area of 41.8 sq. ft. (3.88 m.²). Double-slotted trailing-edge flaps between ailerons and fuselage, with total area of 150 sq. ft. (13.94 m.²). Hydraulic operation. Gross wing area 864 sq. ft. (79.89 m.²).

FUSELAGE.—All-metal monocoque structure of circular cross-section.



The Martin RM-1, the U.S. Coast Guard version of the 4-0-4 airliner.

TAIL UNIT. Cantilever monoplane type of all-metal construction. Dihedral tailplane with variable incidence. Tailplane incidence interconnected with flaps. Statically-balanced rudder and elevators. Elevators interchangeable left and right. Total vertical area 128 sq. ft. (11.89 m.²). Total horizontal area 210 sq. ft. (19.51 m.²). Tailplane span 36 ft. 6 in. (11.13 m.).

LANDING GEAR.—Retractable tricycle type, dual wheels fitted to main legs. Main units each consist of single shock-absorber leg and front link members which retract forward into engine nacelles and are fully enclosed. Steerable nose-wheel, carried in fork on shock-absorber leg, retracts forward into fuselage. Hydraulic operation. Track (centre-line of legs) 25 ft. 0 in. (7.62 m.).

POWER PLANT. -Two Pratt & Whitney R-2800 CB16 Double-Wasp eighteen-cylinder two-row radial air-cooled engines in tapered cowlings and each developing a normal output of 1,800 h.p., and with 2,400 h.p. available for take-off. Hamilton Standard 2H17K3-48R three-blade reversable airscrews. 13 ft. 2 in. (4.01 m.) diameter. Electric anti-icing. Eight Mareng synthetic rubber fuel cells, four in each wing outboard of engine nacelles with under wing refuelling valves and detachable panels underneath wing for removal of cells.

ACCOMMODATION. — Pressurised accommodation for crew of three or four and 40 passengers. Freight and baggage capacity 316 cub. ft. (8.94 m.³). Hydraulically-operated self-contained rear loading ramp. 93 cub. ft. (2.63 m.³) baggage space available under passenger seats. Toilet compartment on starboard at rear, and coat compartment at left forward end of fuselage.

EQUIPMENT.—Hydraulic equipment and other accessory systems carried in space below floor of cabin, with three access panels in fuselage. Thermal anti-icing by four combustion heaters, two in each engine nacelle.

DIMENSIONS.
Span 93 ft. 3 in. (28.44 m.).
Length 74 ft. 7 in. (22.75 m.).
Height 28 ft. 5 in. (8.61 m.).



The Martin B-61 Matador Guided Missile or Pilotless Bomber.

WEIGHTS AND LOADINGS.—
Weight empty (equipped) 29,126 lb. (13,223 kg.).
Max. payload 11,592 lb. (5,263 kg.).
Weight loaded 44,900 lb. (20,385 kg.).
Max. landing weight 43,000 lb. (19,522 kg.).
Wing loading 51.9 lb./sq. ft. (253.3 kg./m.²).
Power loading 9.3 lb./h.p. (4.22 kg./h.p.).

PERFORMANCE.—
Max. speed 312 m.p.h. (500 km.h.) at 14,500 ft. (4,420 m.).
Cruising speed (1,200 h.p. per engine) 280 m.p.h. (448 km.h.) at 18,000 ft. (5,490 m.).
Stalling speed at sea level 81 m.p.h. (129.6 km.h.).
Initial rate of climb 1,905 ft./min. (580 m./min.).
Rate of climb at S/L. one engine at T.O. power and max. T.O. weight 460 ft./min. (140 m./min.).
Service ceiling 29,000 ft. (8,845 m.).
Max. *en route* altitude on one engine at 40,000 lb. (18,160 kg.) 10,400 ft. (3,170 m.).
Normal range 1,080 miles (1,730 km.).
Max. range 2,600 miles (4.160 km.).
Take-off distance (max. T.O. weight) to 50 ft. (15.25 m.) 1,980 ft. (604 m.).
C.A.R. take-off field length over 50 ft. (15.25 m.) obstacle max. T.O. weight, one engine out, flaps at 12½° 3.995 ft. (1.218 m.).
Landing distance from 50 ft. (15.25 m.) at max. landing weight and approach speed 10% above stalling speed 1,750 ft. (534 m.).

THE MARTIN MATADOR.
U.S.A.F. designation: B-61.

The B-61 Matador ground-launched medium-range tactical guided missile, or pilotless bomber, which was developed and built for the U.S.A.F. Research and Development Command, began its tactical tests at the U.S.A.F. Missile Test Center at Cocoa, Florida, on June 21, 1951, the initial launch using for the first time the "down-range" facilities in the Bahama Islands. Previous flight control tests were made at the Holloman Air Force Base, New Mexico.

On October 1, 1951, the first Pilotless Bomber Squadron (Light) equipped with B-61's was formed at Cocoa.

The B-61 is a swept-wing missile which takes off from a mobile launcher under rocket and jet power. When a critical speed is reached the missile's Allison J33 turbojet engine takes over and the rocket drops off.

From Cocoa the missile is tracked by radar stations down range and telemeters information back to the base. Visual contact is also maintained by aircraft.

No other details of the B-61 have been released by the U.S.A.F.

MOONEY
MOONEY AIRCRAFT, INC.

HEAD OFFICE AND WORKS: LOUIS SCHREINER FIELD, KERRVILLE, TEXAS.

President: Charles G. Yankey.

Vice-President, General Manager and Chief Engineer: A. W. Mooney.

Vice-Presidents: A. B. Mooney and W. L. McMahon.

Sales Manager: W. W. Taylor.

The Mooney Aircraft, Inc. was formed by two former executives of the defunct Culver Aircraft Corpn., Mr. Charles G. Yankey, a former President, and Mr. A. W. Mooney, a former engineering Vice-President.

The first product of the new company was the Mooney M-18 single-seat light monoplane, which was designed for extremely economical operation. Two versions were produced, the M-18LA with a 65 h.p. Lycoming O-145 engine and the M-18C with the 65 h.p. Continental A65 engine. Production of the M-18LA was discontinued in early 1953 owing to a shortage of engines but the M-18C continues in production.

The latest product is the M-20 four-seat cabin monoplane. The prototype flew for the first time on August 10 and the aircraft was expected to be in production in the latter part of 1953.

Both the M-18 and M-20 incorporate the Mooney "Safe-Trim" control system which consists of a gear which links the tail-trim with the wing flaps so as to establish automatically proper settings for take-off, climb, approach and landing.

THE MOONEY M-18C MITE.

TYPE.—Single-seat Light monoplane.

WINGS.—Low-wing cantilever monoplane. Single spruce and plywood D-spar structure with fabric covering aft of spar. Ailerons and flaps have welded steel-tube frames and fabric covering. Gross wing area 95 sq. ft. (8.82 m.²).

FUSELAGE.—Mixed structure. Front section to back of pilot's cockpit of welded steel-tube with sheet aluminium-alloy covering rear section a wood monocoque.

TAIL UNIT.—Cantilever monoplane. End of fuselage hinged beneath leading-edge of tailplane for trim. All surfaces of welded steel-tube with fabric covering.

LANDING GEAR.—Retractable tricycle with steerable nose wheel. Rubber shock-absorbers. Hand retraction by lever in cockpit. Warning horn provided. Wheel brakes.

POWER PLANT.—One 65 h.p. Continental A65-8 four-cylinder horizontally-opposed air-cooled engine driving a two-blade fixed-pitch Sensenich wood airscrew. Fuel tank (11 U.S. gallons=41.5 litres) in fuselage.

ACCOMMODATION.—Single-seat cockpit with sliding canopy. Standard three-control system with stick and rudder pedals. Interconnected flaps and tail trim.

DIMENSIONS.—
Span 26 ft. 10½ in. (8.2 m.).
Length 17 ft. 7½ in. (5.45 m.).
Height 6 ft. 2½ in. (1.9 m.).

WEIGHTS AND LOADINGS.
Weight empty 540 lb. (245 kg.).
Disposable load 310 lb. (141 kg.).
Weight loaded 850 lb. (386 kg.).
Wing loading 8.94 lb./sq. ft. (43.62 kg./m.²)
Power loading 13 lb./h.p. (5.9 kg./h.p.).

PERFORMANCE. -
Max. speed at S/L. 142 m.p.h. (227 km.h.).
Optimum cruising speed at 10,000 ft. (3,050 m.) 130 m.p.h. (208 km.h.).
Economic cruising speed at S/L. 115 m.p.h. (184 km.h.).
Stalling speed (power off) 43 m.p.h. (69 km.h.).
Rate of climb at S/L. over 1,000 ft./min. (305 m./min.).
Ceiling over 21,000 ft. (6,400 m.).
Take-off run 300 ft. (91.5 m.).
Landing run 275 ft. (84 m.).

THE MOONEY M-20.

TYPE.—Four-seat cabin monoplane.

WINGS.—Low-wing cantilever monoplane. NACA laminar-flow wing section. Single-piece single-spar structure with plywood torsion-box leading-edge and fabric covering aft. Narrow-chord slotted flaps over 70 per cent. of trailing-edge. Sealed gap



The Mooney M-18C Mite (65 h.p. Continental engine).

differentially-operated ailerons. Gross wing area 166.9 sq. ft. (15.50 m.²).

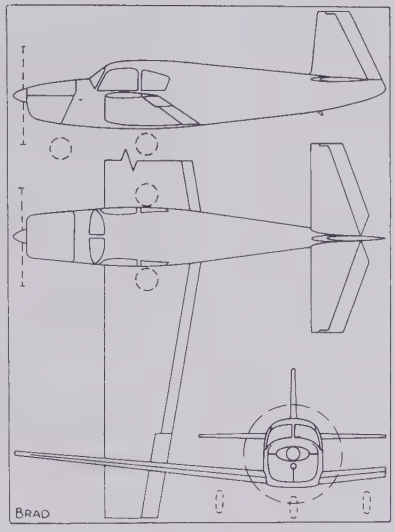
FUSELAGE.—Composite structure. Cabin section is of welded steel-tube with sheet alloy covering. Rear section is a plywood cone with internal formers and stringers and an overall covering of fabric.

TAIL UNIT.—Cantilever monoplane type. All surfaces have welded steel-tube frames and fabric covering. Mooney "Safe Trim" system in which single control operates adjustable tailplane and wing flaps for longitudinal trim and flap control. Tailplane span: 11 ft. 8 in. (3.55 m.).

LANDING GEAR.—Retractable nose-wheel type. Rubber-in-compression shock-absorbers. All wheels same size. Steerable nose-wheel. Hand retraction by lever in cockpit between front seats. Track: 9 ft. 2 in. (2.79 m.). Wheelbase: 5 ft. 4½ in. (1.65 m.).

POWER PLANT.—One 145 h.p. Continental C.145-2H six-cylinder horizontally-opposed air-cooled engine. Sensenich CS-3F airscrew with either selective pitch or constant-speed control. Diameter of airscrew 6 ft. 2 in. (1.88 m.).

ACCOMMODATION.—Cabin seats four in two pairs, front pair with dual controls. Starboard front and rear seats removable for freight stowage. Single door on each side giving access to all seats. Baggage compartment behind cabin with outside door.



The Mooney M-20.

DIMENSIONS.—
Span 35 ft. (10.67 m.).
Length 23 ft. 2⅝ in. (7.07 m.).
Height 8 ft. 3½ in. (2.52 m.).

WEIGHTS AND LOADINGS.—
Weight empty equipped 1,049 lb. (476 kg.).
Pilot and 3 passengers 680 lb. (310 kg.).
Fuel and oil 191 lb. (86 kg.).
Baggage 80 lb. (36 kg.).
Weight loaded 2,000 lb. (908 kg.).
Wing loading 12 lb./sq. ft. (58.5 kg./m.²).
Power loading 13.8 lb./h.p. (6.26 kg./h.p.).

PERFORMANCE (Standard airscrew).—
Max. speed at S/L. 173 m.p.h. (287 km.h.).
Max. speed at 8,000 ft. (2,440 m.) 165 m.p.h. (264 km.h.).
Recommended cruise at 4,000 ft. (1,220 m.) 152 m.p.h. (243 km.h.).
Economic cruise at 8,000 ft. (2,440 m.) 140 m.p.h. (224 km.h.).
Landing speed (flaps at 50°) 45 m.p.h. (72 km.h.).
Rate of climb at S/L. 1,175 ft./min. (358 m./min.).
Climb to 10,000 ft. (3,050 m.) 11.13 min.
Service ceiling 21,000 ft. (6,400 m.).
Absolute ceiling 23,000 ft. (7,015 m.).
Range at optimum cruise 533 miles (703 km.) in 3.3 hrs.
Range at economic cruise 683 miles (1,093 km.) in 4.87 hrs.

NORTH AMERICAN

NORTH AMERICAN AVIATION, INC.

HEAD OFFICE AND WORKS: INTERNATIONAL AIRPORT, LOS ANGELES 45, CAL.

Chairman of the Board: J. H. Kindelberger.

President: J. L. Atwood.

Vice-President in charge of Engineering: R. H. Rice.

Vice-President in charge of Electro-Mechanical Division, Aero-Physics and Atomic Energy Laboratories: L. L. Waite.

Vice-President and General Manager, Columbus Division: C. J. Gallant.

Vice-President: A. T. Burton.

Vice-President and Treasurer: R. A. Lambeth.

North American Aviation, Inc., was incorporated in Delaware in 1928 and from 1934 until 1945 was engaged solely in the design and manufacture of military aircraft. Manufacturing facilities were established at Inglewood, California, in 1935, where a modern production plant was erected on the Los Angeles Municipal Airport. Other facilities have since been acquired in the Los Angeles area.

The company is now engaged in the development, design and manufacture of military aircraft and in research and development in electro-mechanics, aero-physics and atomic energy.

In production are various versions of the F-86 Sabre swept-wing fighter; the AJ-2 Savage naval attack bomber and AJ-2P photographic reconnaissance aircraft, both with a combined jet and piston-engined power-plant; the FJ-2 and FJ-3 Fury swept-wing carrier-based fighters; and the T-28 basic trainer.

The operation of the Government-owned plant at Columbus, Ohio, formerly occupied by the Curtiss Airplane Division of the Curtiss-Wright Corporation, was taken over late in 1950 by North American under an agreement with the U.S. Navy, to meet production requirements which exceed the capacity of the company's facilities in the Los Angeles area.

Total employment at all North American factories and facilities at the beginning of 1953 was about 36,000.

THE NORTH AMERICAN F-100.

The F-100 is a larger and heavier development of the F-86 Sabre. It has a sweepback of 45 degrees as compared with 35 degrees of the F-86, and is powered by a Pratt & Whitney J57 turbojet engine. Other features include flush side air-intakes and a new landing-gear with dual main wheels.

In early test flights the XF-100 is reported to have attained Mach. 1.08 in level flight.

No further details are available.

THE NORTH AMERICAN SABRE.

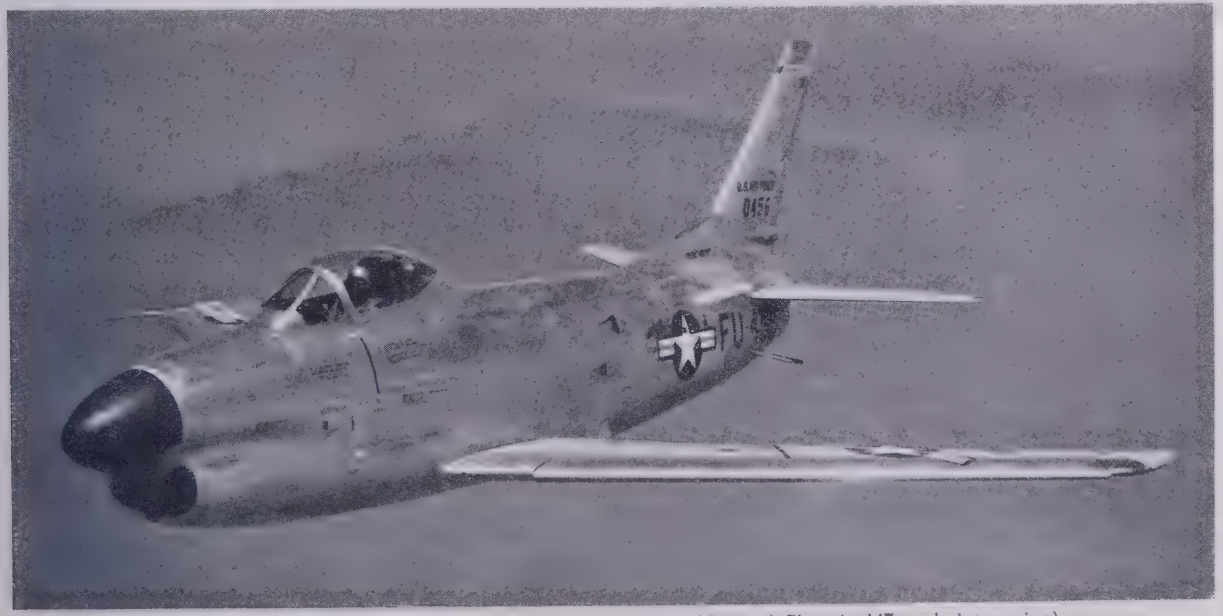
U.S. Air Force designation: F-86.

The F-86 was the first American fighter aircraft to be designed with swept-back wings and tail-unit and was the first swept-wing fighter to go into combat. In two years of fighting in Korea the F-86 maintained its superiority over the Russian MIG-15 and set up an impressive combat record.

The Sabre is being built under licence in Canada by Canadair, Ltd., in Australia by the Commonwealth Aircraft Corporation Pty. Ltd., and in Italy by the Fiat company. The Canadian production Sabre has corresponded to the F-86E and has been supplied in quantity to the R.C.A.F., U.S.A.F. and R.A.F. This series, known as the Sabre Mk. 2, was powered by General Electric J47 engines supplied from the United States. It has now been succeeded by the Sabre Mk. 5 fitted with the Canadian Avro Orenda turbojet engine. The Australian-built Sabre, which is based on the F-86F, is fitted with the Rolls-Royce Avon engine, which is also being manufactured in Australia.

The Fiat Sabre, the F-86K, is being built in quantity under a U.S.A.F. contract as an MDAP contribution to European defence.

The following are the principal versions of the F-86:—



The North American F-86D Sabre All-weather Fighter (General Electric J47 turbojet engine).



The North American F-86D Sabre All-weather Fighter (General Electric J47 turbojet engine).

XF-86. Two prototypes originally fitted with the Allison J35-GE-3 engine. First prototype flew on October 1, 1947. Were later re-engined with the General Electric J47. Re-engined XF-86 first exceeded Mach. 1 on April 25, 1948.

F-86A. First production model. One General Electric J47-GE-1, -3, -9 and -13 engines in successive production series. First production aircraft flew on May 20, 1948. On September 15, 1948, a standard F-86A complete with armament and normal combat equipment and flown by Major Richard L. Johnson, U.S.A.F. established a World's Speed Record of 670.981 m.p.h. (1,073.569 km.h.) over the measured course on Muroc Lake. Out of production in December, 1950.

F-86D. All-weather fighter development of the F-86A. Air intake repositioned under nose, which now encloses radar scanner. General Electric J47-GE-17 engine with G.E. afterburner necessitating a larger rear fuselage. Fully-powered "flying tail," there being no separate elevator surfaces as in F-86E. Equipment includes A.I., armament-laying and tracking, navigation and transponder radar, Sperry Zero-Reader low approach equipment and Hamilton Standard air-conditioning. Armament consists of 24 × 2.75 in. rockets which are carried in a retractable launching tray located in the underside of the fuselage. Overall length 31 ft. (12.5 m.). Other dimensions as for F-86E. Prototype flew on December 22, 1949. In production at Los Angeles.

On November 19, 1952, a standard F-86D with full combat load and piloted by Capt. J. Slade Nash, U.S.A.F., set up a World's Speed Record of 698.505 m.p.h.



The retractable rocket tray of the F-86D Sabre.

(1,124.137 km.h.). The record was made over a measured 3 km. course at Salton Sea, Cal., which is 240 ft. below sea level (Temp. 76°F.). On July 16, 1953, Lieut.-Col. W. F. Barns, U.S.A.F., also in an F-86D equipped for operational duty, increased the World's Speed Record to 715.697 m.p.h. (1,151.798 km.h.) over the same 3 km. course (Temp. 100.5°F.).

F-86E. One General Electric J47-GE-13 engine. Progressive development of F-86A. New tail with both tailplane and elevators controllable and linked for co-ordinated movement. All controls power-operated and provided with artificial sensing system to give pilot a representative feel in absence of air loads. Irreversible control system also provided with a pressure-sensing unit which increases artificial feel force when longitudinal control is threatened by excessive loads on tail. In other respects similar to F-86A, which it followed on production line at Los Angeles in December, 1950. Production completed in April, 1952.

F-86F. One General Electric J47-GE-27 engine. Slightly larger and more powerful development of F-86E. First flew in March, 1951. In production at both Los Angeles and Columbus.

F-86H. General Electric J73-GE-3 engine. Higher powered ground support and low level attack version of F-86F, with larger power-boost tailplane without dihedral, heavier landing-gear, improved suspension and release mechanism for carrying droppable wing tanks in conjunction with bombs and rockets. Clam-shell-type canopy as in F-86D, improved ejector seat, etc. In production at Columbus, Ohio.

F-86K. This is the F-86D assembled and produced by Fiat in Italy. Will have a modified armament and reduced electronic equipment.

The description below refers to the F-86E.

TYPE.—Single-seat Fighter.

WINGS.—Low-wing cantilever monoplane. NACA 0012-64 (root), 0011-64 (tip) laminar-flow wing section. Maximum thickness at 50% of chord. 35° sweepback along 25% chord line. All-metal two-spar structure with upper and lower skins, each of which is a sandwich consisting of two sheets



The North American F-86F Sabre Fighter (General Electric J47 turbojet engine).



The North American F-86H Sabre Attack Fighter (General Electric J73 turbojet engine).

milled to tapering thickness separated by "hat" section extrusions, the whole forming a torsion-box structure. Ailerons over 55% of half span, 24% of chord. 10° up and down deflection. Aileron hydraulic boost and artificial fuel system. Split flaps inboard of ailerons, 60° maximum deflection. Leading-edge slots on outer 70% of span of each wing. Gross wing area 274 sq. ft. (25.4 m.²).

Fuselage.—Oval section all-metal structure with flush-riveted stressed skin. Air brakes on fuselage.

Tail Unit.—Cantilever monoplane type. All-metal structure. All surfaces have 35° sweep-back. "Flying tail" in which elevators and tailplane are geared together and move differentially with movements of control column to provide in-flight trim. Column controls hydraulic valve which permits high-pressure fluid to flow into tailplane actuating cylinder. Artificial feel built in.

Landing Gear.—Retractable tricycle type with steerable nose-wheel. Hydraulic retraction. Cleveland 8657 air-oil shock struts. Bendix 26 in. (66 cm.) cast magnesium wheels and Bendix rotor-disc hydraulic brakes on main wheels. Track 8 ft. 3 in. (2.5 m.).

Power Plant.—One General Electric J47-GE-13 axial-flow turbojet (5,200 lb. = 2,360 kg. s.t.) with straight ram air entry in nose of fuselage. Nose entry lipped above to maintain adequate air flow in nose-up position. Main fuel tanks in fuselage. External long-range drop-tanks may be carried under wings outboard of landing-gear.

Accommodation.—Pressurised pilot's cockpit with sliding "bubble" canopy. Pilot ejection seat.

Armament.—Six 0.50-in. (12.7 mm.) machine-guns in nose. Provision for sixteen 5-in. (127 mm.) rockets under wings. May also carry 2 × 1,000-lb. or 2 × 2,000-lb. bombs in lieu of auxiliary tanks.

Dimensions.—
Span 37 ft. 1 in. (11.3 m.).
Length 37 ft. 6 in. (11.45 m.).
Height 14 ft. (4.27 m.).

Loaded Weight.—
16,500 lb. (7,490 kg.).

Performance.—
Max. speed over 670 m.p.h. (1,072 km.h.).
Service ceiling: 53,000 ft. (16,170 m.).
Tactical radius: 535 miles (856 km.).
Normal cruise range: 1,250 miles (2,000 km.).
Ferry range with external tanks: 2,350 miles (3,760 km.).

THE NORTH AMERICAN FURY.

U.S. Navy designation: FJ-2 and FJ-3.

The FJ-2 is a single-seat swept-wing carrier fighter which is a naval development of the F-86 Sabre. It is powered by a General Electric J47 turbojet engine and has the hydraulically-powered irreversible controls with artificial "feel" for the all-movable tail-unit, first introduced in the F-86E.

The landing-gear is similar to that of the Sabre but the nose-wheel unit is so



The prototype North American XFJ-2 Fury Single-seat Naval Fighter (General Electric J47 turbojet engine).



The prototype North American XFJ-2B Fury which was used to test the new 20 mm. cannon armament.

designed that the normal nose-up static altitude can be increased for catapulting.

Extension of the nose-wheel shock strut is by hydraulic means and is achieved by a manually-controlled selector valve which is operated by the carrier deck crew. When the landing-gear is retracted after take-off hydraulic fluid returns to the reservoir. The extendable nose-wheel strut increases the angle between the thrust line and deck from 4 to 8 degrees.

Armament consists of four 20 mm. cannon. A new Navy gun-sight and an improved Navy ejection-seat are fitted.

The new cannon armament was first installed in the XFJ-2B and this aircraft, which was otherwise a standard F-86E, flew for the first time on December 27, 1951. The prototype XFJ-2, a semi-navalised F-86E without armament or folding wings, made its maiden flight on February 14, 1952.

The FJ-2 is in production at Columbus, Ohio.

The FJ-3 is a slightly heavier and somewhat larger development of the FJ-2. Powered by a Wright J65 Sapphire turbojet engine, the new Fury has a greater speed and increased rate of climb as compared with its predecessor. Like the FJ-2 the new Fury has a 35-degree sweptback wing and "all-flying" tail

The FJ-3, which flew for the first time on August 7, 1953, is in the preliminary stages of production at Columbus and will follow the FJ-2 on the production line.



The North American FJ-3 Fury (Wright J65 turbojet engine).

DIMENSIONS (FJ-2).—
Span 37 ft. 1 in. (11.3 m.).
Length 37 ft. 6 in. (11.45 m.).
Height 14 ft. (4.27 m.).

LOADED WEIGHT (FJ-2).—
About 18,000 lb. (820 kg.).

THE NORTH AMERICAN SAVAGE.

U.S. Navy designation : AJ.

The Savage, a large composite-powered carrier-borne Attack Bomber capable of carrying an Atomic bomb, is in production for the U.S. Navy. The unique power-plant of the Savage consists of two Pratt & Whitney R-2800 piston engines under



The North American AJ-1 Savage (two Pratt & Whitney R-2800 piston engines and one Allison J33 turbojet).
(Warren Bodie).

the wings and a single Allison J33 turbojet in the rear fuselage. The turbojet gives added power when required for accelerated take-off or in combat. All the engines use the same type of fuel.

Two XAJ-1 prototypes were built, the first flying for the first time on July 2, 1948.

The following versions of the Savage have been revealed.

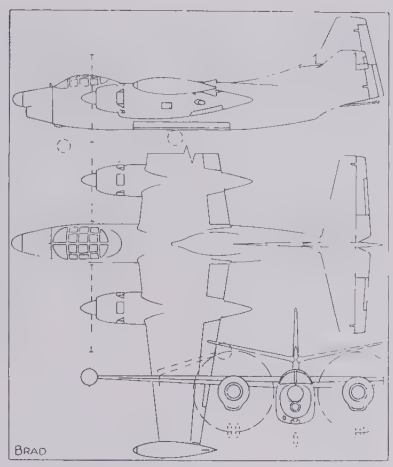
AJ-1. Two 2,400 h.p. Pratt & Whitney R-2800-44W piston engines and one Allison J33-A-10 turbojet (4,600 lb. = 2,090 kg.) s.t. Crew of three. First production AJ-1 flew in May, 1949. First carrier landings in U.S.S. *Coral Sea* on August 31, 1950. Now out of production. AJ-1's being converted into air tankers with Flight Refuelling "probe-drogue" equipment now standard in U.S. Navy. Conversion to tanker by complete pack in bomb-bay comprising hose, drum, fuel pumps, electric power drive, drogue, etc. Additional fuel capacity for tanker duties provided by jettisonable tanks.

AJ-2. Development of AJ-1. Higher vertical fin. Dihedral removed from tailplane. The first AJ-2 flew on February 19, 1953. Production at Columbus, Ohio.

AJ-2P. Photographic-reconnaissance version of AJ-2. 18 cameras for day and night photography at high and low altitudes. Photo-flash bombs in bomb-bay for night reconnaissance. Automatic control for most of cameras. Additional fuel capacity. Weight (approx.) 50,000 lb. (22,700 kg.). Maximum speed with jet power (approx.) 425 m.p.h. (680 km.h.). First AJ-2P flew on March 6, 1952. In production at Columbus, Ohio.

The general arrangement of the Savage can be gathered from the accompanying photograph. The outer wings fold inboard and the fin and rudder fold down on to the starboard tailplane. There is pressurised accommodation for a crew of three. No other details have been released for publication.

DIMENSIONS.—
Span 71 ft. 5 in. (21.77 m.).
Length 63 ft. 1 in. (19.22 m.).
Height (folded) 15 ft. 2 in. (4.62 m.).
Width (folded) 48 ft. (14.64 m.).



The North American AJ-2P.

THE NORTH AMERICAN XA2J-1.

The XA2J-1 is an experimental turboprop version of the Savage. The first of two prototypes for the U.S. Navy flew for the first time on January 4, 1952.

The aircraft is powered by two Allison T40 turboprop engines, each driving an Aeroproducts six-blade contra-rotating airscrew. The turbojet engine has been eliminated and replaced by a remote-controlled tail turret with radar laying and tracking.

The XA2J-1 has a maximum take-off weight of over 26 short tons (23,600 kg.), can carry a bomb load of 10,000 lb. (4,540 kg.) and has a maximum speed of over 400 m.p.h. (640 km.h.). No further details are available.

THE NORTH AMERICAN T-28.

The T-28 was originally designed for the U.S.A.F. as a replacement for the T-6 and it went into production for the U.S.A.F. in 1950 as the T-28A.

In 1952, following the policy of standardisation of training aircraft for all the services, the T-28 was adopted by the U.S. Navy and in modified form was put into production under the designation T-28B.

The two T-28 versions differ in the following respects :—

T-28A. 800 h.p. Wright R-1300-1 seven-cylinder radial engine and Aero Products two-blade constant-speed airscrew. U.S.A.F. advanced trainer. Fully described in detailed specification below.

T-28B. 1,425 h.p. Wright R-1820 engine driving a two-blade Hamilton Standard constant-speed airscrew. U.S. Navy advanced trainer structurally similar to T-28A. New cockpit canopy, which has also been introduced in later production T-28A's. Air brake on lower surface of fuselage. All training armament external with gun mounts, rocket and bomb racks under wings. Gunsight and camera in front cockpit. Rearrangement of radio, electrical and oxygen equipment.

The description which follows refers specifically to the T-28A, but weights and performances of both versions appear on the next page.

TYPE.—Two-seat Basic Trainer.

WINGS.—Low-wing cantilever monoplane. Two-spar all-metal structure. Trailing-edge flaps between ailerons and fuselage. Total flap area 53.6 sq. ft. (4.98 m.²). Gross wing area 268 sq. ft. (24.89 m.²).

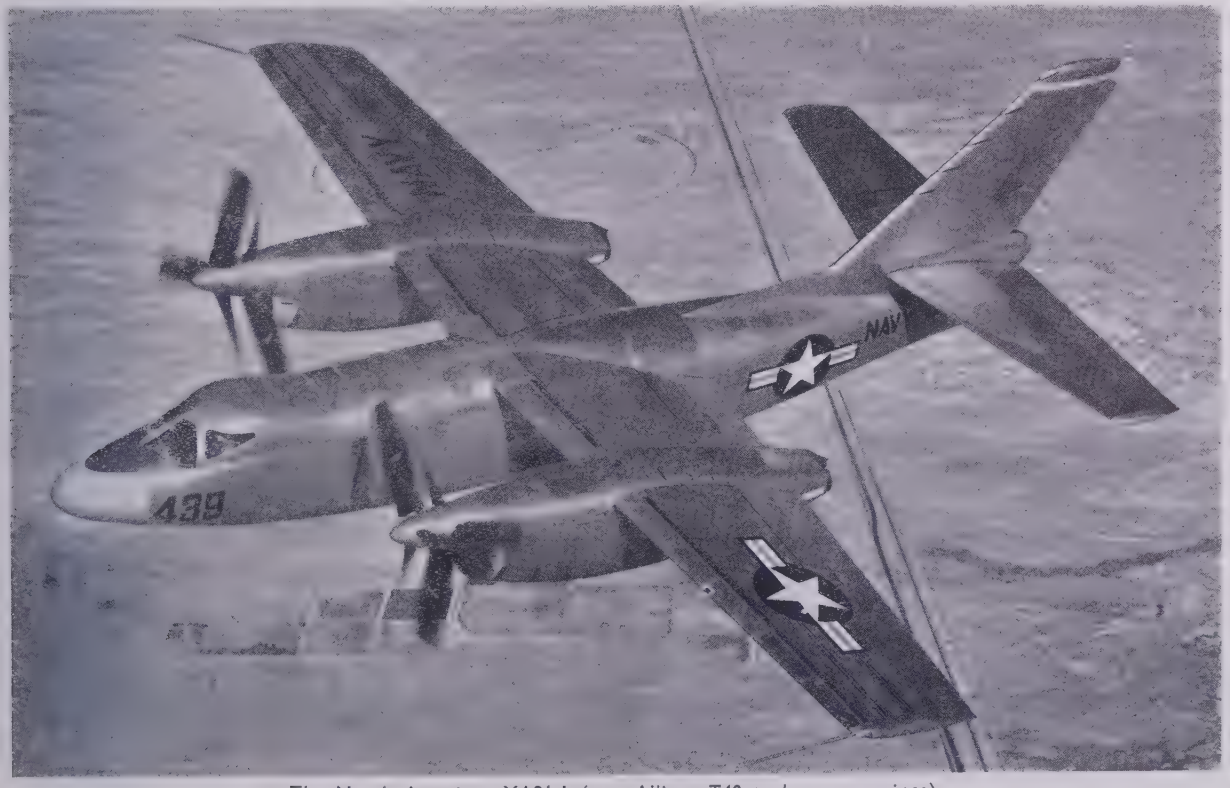
FUSELAGE.—All-metal semi-monocoque structure.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Area of fin and rudder 30.3 sq. ft. (2.81 m.²), area of sailplane and elevators 59.7 sq. ft. (5.54 m.²).

LANDING GEAR.—Retractable tricycle type. Main wheels with Goodyear single-disc brakes retract inwardly into wings, nose-wheel backwards into fuselage. United Aircraft Products air-oil shock struts. Nose wheel is steerable from either cockpit by electro-hydraulic boost control. Nose wheel also carries a movable taxi light. Main wheel track 12 ft. 8 in. (3.86 m.).

POWER PLANT.—One Wright R-1300-1 seven-cylinder radial air-cooled engine with a military and take-off rating of 800 h.p. and a normal rating of 700 h.p. Aero Products two-blade constant-speed airscrew 10 ft. (3.05 m.) diameter. Fuel capacity 125 U.S. gallons (473 litres).

ACCOMMODATION.—Tandem cockpits beneath single bubble canopy. Duplicated flight controls and instruments. Amber screen blind and night flying equipment with



The North American XA2J-1 (two Allison T40 turboprop engines).

ultra-violet and infra-red instrument lighting. Armament, gun-sight, radio, etc. easily installed and removed.

DIMENSIONS.—
Span 40 ft. 1 in. (12.23 m.).
Length 32 ft. (9.76 m.).
Height overall 12 ft. 8 in. (3.86 m.).

WEIGHTS AND LOADINGS (T-28A).—
Weight empty 5,111 lb. (2,320 kg.).
Normal loaded weight 6,365 lb. (2,890 kg.).
Max. take-off weight 6,759 lb. (3,068 kg.).
Wing loading 23.8 lb./sq. ft. (116.14 kg./m.²).
Power loading 7.96 lb./h.p. (3.61 kg./h.p.).

WEIGHTS AND LOADINGS (T-28B).—
Weight empty 6,424 lb. (2,916 kg.).
Normal loaded weight 8,004 lb. (3,634 kg.).
Max. T.O. weight 8,486 lb. (3,853 kg.).
Normal wing loading 29 lb./sq. ft. (141.52 kg./m.²).
Normal power loading 5.6 lb./h.p. (2.54 kg./h.p.).

PERFORMANCE (T-28A).
Max. speed 283 m.p.h. (453 km.h.) at 5,900 ft. (1,800 m.).
Cruising speed 190 m.p.h. (304 km.h).
Stalling speed 72 m.p.h. (115.2 km.h.).
Initial rate of climb 1,870 ft./min. (570 m./min.).
Service ceiling 24,000 ft. (7,320 m.).
T.O. run to clear 50 ft. (15.25 m.) 570 yds. (521 m.).
Max. range 1,008 miles (1,612 km.).

PERFORMANCE (T-28B).—
Max. speed 343 m.p.h. (549 km.h.).
Cruising speed 310 m.p.h. (496 km.h.) at 30,000 ft. (9,150 m.).
Initial rate of climb 3,540 ft./min. (1,080 m./min.).
Service ceiling 35,500 ft. (10,830 m.).
T.O. run to clear 50 ft. (15.25 m.) 380 yds. (348 m.).
Max. range 1,060 miles (1,696 km.) at 10,000 ft. (3,050 m.).





The North American T-28A (above) and T-28B (below) Basic Trainers.

NORTHROP

NORTHROP AIRCRAFT, INC.

HEAD OFFICE AND WORKS: 1001 EAST BROADWAY, HAWTHORNE, CALIFORNIA.

Chairman of the Board, President and General Manager: Oliver P. Echols.

Vice-President: John W. Myers.

Vice-President—Engineering: Edgar Schmued.

Vice-President—Manufacturing: Kenneth P. Bowen.

Vice-President—Treasurer: Roland J. Pagen.

Secretary and Corporation Counsel: George Gore.

Assistant Secretary: Alan C. Morgan.

Assistant Secretary (Washington, D.C.): S. W. Towle, Jr.

Assistant Treasurer: Charles C. Cilley.

Northrop Aircraft, Inc. was formed in 1939 by John K. Northrop and others to undertake the design and manufacture of military aircraft.

During World War II the company produced the N3PB seaplane used by the Royal Norwegian Air Force and the P-61 Black Widow night fighter. It was also engaged in large-scale sub-contract work for other aircraft manufacturers.

During the war and for a short while after the company devoted considerable attention to the design and construction of "Flying Wing" type aircraft. Details of this work together with descriptions and illustrations of the various "Flying Wing" types built have appeared in previous editions of "All the World's Aircraft."

Northrop is now in production with the F-89 Scorpion all-weather interceptor fighter for the U.S.A.F. It is also engaged on several military projects of a secret nature.

John K. Northrop, the founder of the company, retired in November, 1952.

THE NORTHROP SCORPION.
U.S. Air Force designation: F-89.

The following are the principal versions of the F-89 Scorpion :—

F-89A. First production model. Armament consists of six nose-mounted 20 mm. cannon.

F-89B. Second production model. Generally similar to the F-89A but with certain internal and equipment changes.

F-89C. Progressive development of F-89B. External mass-balances on elevators suppressed.

F-89D. Rocket armament replaces the six 20 mm. nose-mounted cannon of earlier F-89 versions. A total of 104 2.75 in. folding-fin air-to-air rockets carried in permanently mounted wing-tip pods. Electronic aiming and automatic triggering equipment. Additional fuel gives 11 per cent. increase in range as compared with F-89C.

The description below refers specifically to the F-89A.

TYPE.—Twin-engined two-seat All-weather Interceptor Fighter.

WINGS.—Low-wing cantilever monoplane. Thin-section high-lift low-drag wing-section. Thickness ratio 8½% at root, 7½% at tip. Taper ratio 2 : 1. Aspect ratio 4.5 : 1. Leading-edge sweep back 5°. All-metal multi-cellular structure. Double slotted flaps inboard of ailerons. The power-operated ailerons, or "decelerons," are split so as to serve as ailerons or dive-brakes. The upper and lower segments may be opened up and down simultaneously to serve as air brakes; or with the segments closed the surfaces operate as conventional ailerons. Hot-air anti-icing. Aileron area 45 sq. ft. (4.18 m.²). Flap area 63 sq. ft. (5.85 m.²). Gross wing area 562 sq. ft. (52.20 m.²).

FUSELAGE.—Oval section all-metal structure. Built in halves with joint along vertical centre-line, each half being equipped before assembly to central vertical keel which serves as mounting member for, and intervening firewall between, the two engines.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Power-operated control surfaces operated by aircraft hydraulic system, with emergency electrical actuation should hydraulic power fail. Tailplane span 11 ft. 6 in. (3.50 m.). Tailplane area 110 sq. ft. (10.22 m.²). Elevator area 25



The Northrop F-89C Scorpion All-weather Fighter (two Allison J35 turbojet engines). (*Warren Bodie*).



The Northrop F-89D Scorpion All-weather Fighter firing its wing-tip-mounted rocket armament.

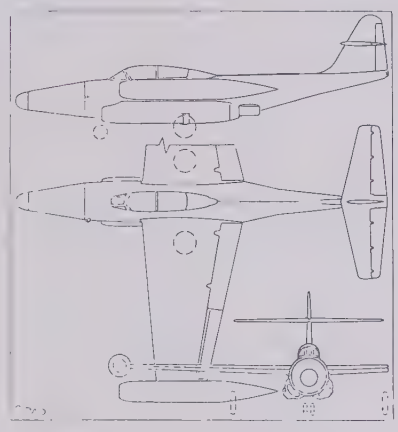
sq. ft. (2.32 m.²). Vertical tail area (fin and rudder) 38 sq. ft. (3.53 m.²).

LANDING GEAR.—Retractable tricycle type. Main wheels are of large diameter and thin enough to permit total enclosure in wings when retracted. 165 lb./sq. in. tyre pressure. Hydraulic retraction.

POWER PLANT.—Two Allison J35 turbo-jet engines, each with a static (dry) thrust rating of 5,200 lb. (2,360 kg.). Solar after-burners with adjustable nozzles. Engines mounted one on each side of fore-and-aft fuselage keel low down and only partly within the fuselage contour. Engines may be lowered clear of mountings by built-in hydraulic hoist for ground level maintenance. Four lightweight Goodyear bullet-proof tanks in fuselage and twelve Goodyear Pliocel bladder tanks in wings. Wing-tip tanks.

ACCOMMODATION.—Crew of two, pilot and radar operator, in tandem in pressurised cockpit. Power-operated jettisonable canopy and ejection seats. Cabin heating and refrigeration.

ARMAMENT.—Six 20 mm. cannon in nose.



The Northrop F-89D Scorpion.

Comprehensive radar and night flying and fighting equipment.

DIMENSIONS.—
Span 56 ft. 2 in. (17.13 m.).
Length 53 ft. 4 in. (16.26 m.).
Height 17 ft. 7 in. (5.36 m.).

WEIGHTS (F-89A).—
Weight empty 19,800 lb. (8,990 kg.).
Normal loaded weight 32,500 lb. (14,755 kg.).
Max. overloaded weight 40,000 lb. (18,160 kg.).

PERFORMANCE (F-89A).—
Max. speed over 670 m.p.h. (1,072 km.h.).
Max. speed with afterburner over 700 m.p.h. (1,120 km.h.).
Cruising speed over 530 m.p.h. (848 km.h.).
Service ceiling 52,000 ft. (15,860 m.).
Combat radius 875 miles (1,400 km.).
Max. range 2,600 miles (4,160 km.).

THE NORTHROP X-4.

The X-4 is a twin-jet single-seat swept-wing research monoplane which is intended to explore the stability and flight characteristics of aircraft of the swept-back all-wing configuration at subsonic speeds.

The swept wings are fitted with "elevons" which serve as both ailerons and elevators, as the short fuselage only carries a single swept-back fin and rudder. The two Westinghouse J30 jet engines are located in the wing roots alongside the fuselage.

The pilot's cockpit is fitted with ejection seat and very comprehensive NACA instrumentation is installed.

Two X-4's were built for the U.S. Air Force. They are now engaged in research flying under the direction of the NACA.

DIMENSIONS (Approx.).—
Span 23 ft. 4 in. (7.11 m.).
Length 26 ft. 10 in. (8.17 m.).
Height 14 ft. 10 in. (4.52 m.).

DESIGN GROSS WEIGHT (Approx.).—
7,000 lb. (3,180 kg.).



The Northrop X-4 Research Monoplane. (*Gordon Williams*).

PIASECKI

PIASECKI HELICOPTER CORPORATION.

HEAD OFFICE AND WORKS: MORTON, PENNSYLVANIA.

Chairman: Frank N. Piasecki.

President: Don. R. Berlin.

Executive Vice-President and General Manager: C. Hart Miller.

Vice-Presidents: Harry S. Pack and Elliot Daland.

Vice-President and Secretary: Wesley R. Frysztacki.

Vice-President and Chief Engineer: L. L. Douglas.

Vice-President and Treasurer: Gareth W. Speer.

The Piasecki Helicopter Corpn., known until 1946 as the P-V Engineering Forum, originated in August, 1940, when a discussion group of several engineers interested in the development of rotary-wing aircraft started meeting in their spare time.

Shortly after this group was formed it began design work on a small helicopter which was later built and designated the PV-2. This aircraft, first flown on April 11, 1943, was the second American helicopter to be flown publicly. It was illustrated and described in the 1945-46 edition of this Annual.

Since then the company has developed a number of successful tandem rotored helicopters; the HRP and HUP and their derivatives for the U.S. Navy and the H-25 for the U.S.A.F. and U.S. Army. In service are the HRP-1, HRP-2, HUP-1, HUP-2 and YH-21. At present in production are the HUP-2, H-25A and H-21 Series, while under development are the XH-16 and XH-16A.

The U.S.A.F. contract for the XH-16 and XH-16A involves the development of an extremely large utility transport tandem helicopter for long-range rescue (U.S.A.F.) or troop and equipment transport (U.S. Army). The first unit, a dynamic test article, is scheduled for completion sometime in the Spring of 1953.

In February 1950 the company was awarded a U.S.A.F. contract for a substantial quantity of YH-21 Arctic rescue helicopters, a development of the naval HRP-2. Subsequent orders have been placed by the U.S.A.F. for H-21A, and by the U.S.A.F. and Army for higher-powered H-21B and H-21C rescue helicopters.

THE PIASECKI PD-18 RETRIEVER.
U.S. Navy designation: HUP.
U.S. Army designation: H-25A.

This single-engined tandem-rotored helicopter was designed to meet the requirements of the U.S. Navy for ship-board operation, including carrier plane guard duty, rescue, observation and inter-ship and ship-to-shore utility transport duties. It was required to negotiate the smallest aircraft-carrier lift without blade folding and to go down a standard cruiser aircraft lift with blades folded.

After completing an extensive Navy evaluation programme the prototype XHJP-1 was adopted by the U.S. Navy as a Fleet helicopter and a production order for twenty-two, under the designation HUP-1, was awarded to the company. Subsequently additional orders have been placed for the HUP-1 and the higher-powered HUP-2 by the U.S. Navy, and for the H-25A by the U.S. Army.

The HUP helicopter has an all-metal soundproofed fuselage with a normal accommodation for a crew of two and four passengers or three stretcher cases. A large loading door and ample cabin dimensions also permit the transport of a wide variety of high or low density cargo. An internally-operated rescue hatch adjacent to the pilot's seat is large enough to allow the passage of a loaded stretcher. A hydraulically-operated hoist above the hatch is used for hoisting survivors while hovering, and if a rescue sling is used the pilot can conduct the entire loading operation without assistance.

The several versions of this helicopter which are in service or in production are identified below.

HUP-1. 525 h.p. Continental R-975-34 engine. First production model. First deliveries in 1950.

HUP-2. 550 h.p. Continental R-975-42 engine. As the result of successful trials in automatic control in all flight conditions with the prototype XHJP-1, using a modified Sperry automatic pilot, all production HUP-2's have an auto-pilot as primary controller. This permits the elimination of the tail stabilising surfaces used in the HUP-1. Used for anti-submarine operations as well as plane guard rescue and utility duties.

HUP-3. Progressive development of HUP-2.

H-25A. U.S. Army version of HUP-3.

The following data specifically concerns the HUP-1.

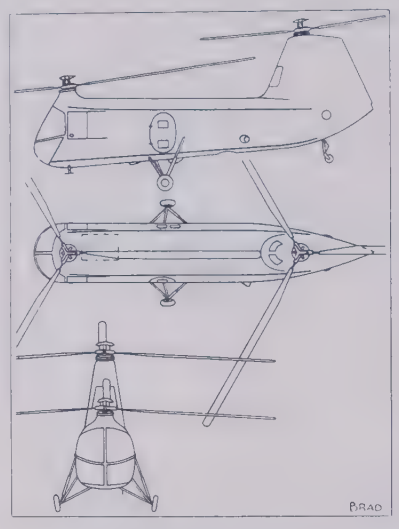
DIMENSIONS.—
- Length (blades extended) 40 ft. 3 in. (12.27 m.).
- Length of fuselage (blades folded) 32 ft. (9.75 m.).
- Width (blades extended) 30 ft. 6 in. (9.30 m.).
- Width (blades folded) 12 ft. 11 in. (3.91 m.).

WEIGHTS.—
- Empty 3,965 lb. (1,802 kg.).
- Normal loaded 5,450 lb. (2,477 kg.).
- Max. permissible overload weight 5,736 lb. (2,607 kg.).

PERFORMANCE.—
- Max. speed over 120 m.p.h. (193 km.h.).
- Cruising speed over 85 m.p.h. (137 km.h.).
- Initial rate of climb (forward flight) 1,200 ft./min. (366 m./min.).
- Vertical rate of climb 860 ft./min. (262 m./min.).
- Hovering ceiling out of ground effect 7,400 ft. (2,260 m.).
- Service ceiling 12,500 ft. (3,812 m.).



The Piasecki HUP-1 General Utility Naval Helicopter.



The Piasecki HUP-2.



The Piasecki H-25A Army Mule Helicopter.

THE PIASECKI RESCUER.

U.S. Navy designation : HRP.

The HRP was the first large tandem-rotored transport helicopter to be put into production by Piasecki. The prototype XHRP-1 was first flown in March, 1945, and an initial service test order for ten HRP-1's was placed by the U.S. Navy in June, 1946, followed later by a further production order for ten. In June, 1948 the U.S. Navy placed a further limited production contract for an improved and modernised development known as the HRP-2. These two versions are distinguished as follows :—

HRP-1. 600 h.p. Pratt & Whitney R-1340 engine. Fabric covering on forward fuselage. Normal accommodation for crew of two (in tandem) and eight passengers, or six stretchers. Maximum load 2,000 lb. (908 kg.). Normal A.U.W. 6,900 lb. (3,133 kg.). Maximum speed 104 m.p.h. (167 km.h.). In service with U.S. Navy, Marine Corps and Coast Guard.

HRP-2. Same power-plant. All-metal fuselage of improved shape and decreased drag. Modified nose section seats crew of two side-by-side with dual controls. Cabin 20 ft. (6.10 m.) long, 5 ft. 6 in. (1.68 m.) high and 5 ft. 6 in. (1.68 m.) wide. HRP-2's are being used by the U.S. Marine Corps in developing airborne amphibious assault techniques. The data below refers specifically to the HRP-2.

DIMENSIONS.—
- Rotor diameter 41 ft. (12.50 m.).
- Length 54 ft. (16.47 m.).
- Height 14 ft. 10 in. (4.52 m.).



The Piasecki HRP-2 Transport Helicopter (600 h.p. Pratt & Whitney R-1340 engine).



The Piasecki H-21C Army Cargo and Troop-carrying Helicopter (1,425 h.p. Wright R-1820 engine).

WEIGHTS.—
Empty 5,301 lb. (2,409 kg.).
Loaded 7,225 lb. (3,284 kg.).
PERFORMANCE.—
Max. speed at S.L. 105 m.p.h. (168 km.h.).
Cruising speed 92 m.p.h. (148 km.h.).
Vertical rate of climb 400 ft./min. (121 m./min.).

THE PIASECKI PD-22.
U.S.A.F. and Army designation: H-21.

This is a modified and higher powered version of the HRP-2 which has been ordered by the U.S.A.F. and U.S. Army in the three following versions :—

YH-21 and H-21A. One Wright R-1820-103 engine with power limited to 1,150 h.p. Arctic rescue helicopter. Cabin dimensions as for HRP-2. Crew of two, pilot and co-pilot (or medical attendant), and accommodation for twelve stretchers or fourteen troops. 400 lb. (182 kg.) capacity swinging boom-type hydraulic hoist above large sliding door immediately behind pilot on starboard side for transferring loads while hovering, and further door on port side aft for loading and unloading on gound. Each wheel of fixed landing-gear surrounded with inflatable ring floats to permit landing on water, marsh and land. Equipment includes cabin insulation and heating, blind-flying instruments, etc.

H-21F. One 1,425 h.p. Wright R-1820-103 engine. Troop and cargo transport capable of performing assault airlift, transport of troops and equipment, and rescue and evacuation missions for U.S. Air Force and Army Field Forces. Interior and exterior dimensions same as for H-21A. Crew as for H-21A. Cabin accommodates twelve stretchers or twenty troops. Forward door and swinging boom hoist as for H-21A but rear door larger and two extra windows added. Cargo sling for exterior suspension of large loads beneath fuselage. Tie-down fittings in cabin floor for anchoring freight, troop seats or stretcher supports. Equipment includes self-sealing fuel tanks (283 U.S. gallons = 1,050 litres total capacity), provision for jettisonable auxiliary fuel tanks, pilot-controlled searchlight, fixed landing-light, hydraulic inflatable floats around wheels, hydraulic control boost and autopilot.

H-21C. Army troop-carrier and resupply version of H-21B.

DIMENSIONS.
Rotor diameter 44 ft. (13.42 m.).
Length 52 ft. 6 in. (16.0 m.).
Height 16 ft. (4.88 m.).
WEIGHTS (H-21A).—
Weight empty 8,088 lb. (3,676 kg.).
Normal disposable load 3,412 lb. (1,551 kg.).
Disposable overload 6,412 lb. (2,915 kg.).
Normal loaded weight 11,500 lb. (5.227 kg.).
Max. overloaded weight 14,500 lb. (6,591 kg.).
WEIGHTS (H-21B).—
Weight empty 8,906 lb. (4,048 kg.).
Normal disposable load 4,350 lb. (1,977 kg.).
Disposable overload 6,154 lb. (2,794 kg.).
Normal loaded weight 13,256 lb. (6,025 kg.).
Max. overloaded weight 15,000 lb. (6,818 kg.).
PERFORMANCE (H-21A).—
Max. speed at S/L. 138 m.p.h. (222 km.h.).
Cruising speed for max. range 104.6 m.p.h. (168 km.h.).
Vertical rate of climb 830 ft./min. (253 m./min.).
Forward rate of climb 1,640 ft./min. (501 m./min.).
Hovering ceiling out of ground effect 8,400 ft. (2,560 m.).
Service ceiling 15,300 ft. (4,670 m.).
Normal range at S/L. 600 miles (960 km.).
Ferry range at max. overloaded weight 1,440 miles (2,330 km.).
PERFORMANCE (H-21B).—
Max. speed at S/L. 117 m.p.h. (189 km.h.).
Cruising speed for max. range 101.2 m.p.h. (163 km.h.).
Vertical rate of climb 830 ft./min. (253 m./min.).
Forward rate of climb 1,420 ft./min. (433 m./min.).
Hovering ceiling out of ground effect 4,500 ft. (1,370 m.).
Service ceiling 10,800 ft. (3,290 m.).
Normal range at S/L. 500 miles (800 km.).
Ferry range at max. overloaded weight 1,236 miles (1,980 km.).

THE PIASECKI PV-15 TRANSPORTER.
U.S.A.F. designation : XH-16.

The XH-16 was designed to meet U.S.A.F. requirements for a long-range rescue helicopter and Army requirements for a troop and cargo transport.

The XH-16 is an all-metal twin-engined tandem rotor craft with a standard tricycle-type landing-gear or, alternatively, with a high tricycle landing gear and a detachable pack. It will serve as a long-range rescue helicopter, a troop transport, a freight and cargo transport with detachable pack, and as a high-lift flying crane without pack. When used as a troop transport, seats for forty will be provided in the main fuselage. For medical evacuation, thirty-two stretchers can be installed.

The prototype XH-16, which is powered by two 1,650 h.p. Pratt & Whitney R-2180-11 engines, was completed in August, 1953, but reports of its first flight had not been received at the time of closing for press. A turbine-powered version to have two Allison T38 engines is under development.

No details of dimensions, weights or performance are available for publication.



A drawing of the XH-16 as it will appear when fitted with a standard tricycle landing-gear.



The prototype of the Piper PA-23 Apache (two 150 h.p. Lycoming O-320 engines).

THE PIPER AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: LOCK HAVEN, PENNSYLVANIA.

President and Chairman of the Board: W. T. Piper, Sr.

Executive Vice-President: W. T. Piper, Jr.

Vice-President in charge of Operations: Thomas F. Piper.

Vice-President in charge of Research and Development: Howard Piper.

Chief Engineer: W. C. Jamouneau.

In 1953 Piper Aircraft Corporation entered the twin-engined executive aircraft field with the PA-23 Apache which was scheduled to go into production during the Summer.

The year 1953 also found Piper leading the World in light aircraft sales. Commercial sales of the Tri-Pacer and Super Cub and prime and sub-contracts for the U.S. Army, Air Force and Marine Corps have made it necessary to increase production by 160 per cent. compared with 1952.

For the Army Field Forces, Piper is producing the L-18C, a military version of the Super Cub 95, and the L-21B, the military counterpart of the Super Cub 135.

The U.S.A.F. has contracted with civilian schools giving Air Force training, for cadets to have their first 25 hours of flight training in Piper 18-T trainers and approximately 270 aircraft of this type are being supplied to the schools under this programme. The 18-T is essentially the Super Cub 95 with a 108 h.p. engine, parachute seats and other minor changes.

The PA-22 Tri-Pacer, America's first four-seat nose-wheel aircraft in the low-price field, is so popular that it is outselling its tail-wheel sister, the PA-20 Pacer, by 16 to 1. Piper is also quantity producing the only factory equipped agricultural aircraft, the PA-18-A.

Sub-contracting activities include considerable work for both jet aircraft and helicopter manufacturers.

THE PIPER PA-23 APACHE.

TYPE.—Four-seat cabin monoplane.

WINGS.—Low-wing cantilever monoplane. U.S.A. 35-B (modified) wing section. Aspect ratio 6.8. Chord 5 ft. 7 in. (1.70 m.). Dihedral 5°. All-metal structure. Frise type all-metal ailerons and flaps. Total aileron area 8.375 sq. ft. (0.77 m.²). Gross wing area 204 sq. ft. (18.95 m.²).

FUSELAGE.—All-metal structure.

TAIL UNIT.—Cantilever monoplane type. All-metal. Areas: fin 10.75 sq. ft. (1.00 m.²), rudder 9.75 sq. ft. (0.90 m.²), elevators (total) 18.6 sq. ft. (1.72 m.²), tailplane 18.6 sq. ft. (1.72 m.²).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction. Electrol hydraulic shock-absorber struts. Goodrich wheels. Hydraulic brakes. Wheelbase 7 ft. 8.4 in. (2.36 m.).

POWER PLANT.—Two 150 h.p. Lycoming O-320 six-cylinder horizontally-opposed air-cooled engines. Hartzell two-blade constant-speed full-feathering airscrews. 6 ft. 4 in. (1.93 m.) diameter. Two fuel tanks, one in each wing. Total fuel capacity 72 U.S. gallons (272 litres).

ACCOMMODATION.—Enclosed cabin seating four in two pairs, with dual controls to front pair. Full instrumentation. Omni radio, VHF, LF and automatic D/R equipment.

DIMENSIONS.—
Span 37 ft. (11.28 m.).
Length 27 ft. 2½ in. (8.29 m.).
Height 9 ft. 6 in. (2.89 m.).

WEIGHTS AND LOADINGS.—
Weight empty 2,100 lb. (953 kg.).
Weight loaded 3,650 lb. (1,657 kg.).
Wing loading 15.7 lb./sq. ft. (76.62 kg./m.²).
Power loading 10.7 lb./h.p. (4.85 kg./h.p.).

PERFORMANCE.—
Cruising speed at S/L. 150 m.p.h. (240 km.h.).
Stalling speed 58 m.p.h. (92.8 km.h.).
Initial rate of climb 1,200 ft./min. (366 m./min.).
Absolute ceiling 21,000 ft. (6,405 m.).
Max. cruising range 720 miles (1,150 km.).



The Piper L-18B, a military liaison version of the Super Cub 95.

THE PIPER PA-18 SUPER CUB 95.

U.S. Army designation: L-18.

TYPE.—Two-seat Light Cabin monoplane.

WINGS.—High-wing braced monoplane. Wing structure of aluminium spars and aluminium-alloy ribs, the whole being covered with Duroclad. Steel-tube Vee bracing struts. No flaps. Gross wing area 178.5 sq. ft. (16.58 m.²).

FUSELAGE.—Rectangular welded steel-tube structure covered with Duroclad.

TAIL UNIT.—Braced monoplane type. Welded steel-tube framework covered with Duroclad. Tailplane span 9 ft. 6 in. (2.89 m.).

LANDING GEAR.—Fixed divided type. Two side Vees and half axles hinged to cabane below fuselage. Rubber cord shock absorption. Hydraulic wheel-brakes. Leaf-spring steerable tail-wheel.

POWER PLANT.—One 90 h.p. Continental C90-8F four-cylinder horizontally-opposed air-cooled engine on swinging engine mounting. Two-blade fixed-pitch wood airscrew 6 ft. 2 in. (1.8 m.) diameter. Fuel capacity 18 U.S. gallons (68 litres).

ACCOMMODATION.—Enclosed cabin seating two in tandem with dual controls. Large door on right side and sliding windows on left. Baggage compartment aft of rear seat. Equipment may be installed for spraying, dusting, fertilising, etc.

DIMENSIONS.—
Span 35 ft. 2½ in. (10.72 m.).
Length 22 ft. 4½ in. (6.82 m.).
Height 6 ft. 8 in. (2.03 m.).



The Piper PA-18 Super Cub (90 h.p. Continental C90 engine).

WEIGHTS AND LOADINGS.—
Weight empty 800 lb. (363 kg.).
Disposable load 700 lb. (317 kg.).
Weight loaded 1,500 lb. (680 kg.).
Wing loading 8.4 lb./sq. ft. (50 kg./m.²).
Power loading 16.6 lb./h.p. (7.53 kg./h.p.).
PERFORMANCE.—
Max. speed 110 m.p.h. (176 km.h.).
Cruising speed 100 m.p.h. (160 km.h.).
Stalling speed 42 m.p.h. (67.2 km.h.).
Rate of climb 624 ft./min. (190 m./min.).
Service ceiling 13,500 ft. (4,120 m.).
T.O. run 452 ft. (138 m.).
T.O. to 50 ft. (15.25 m.) 952 ft. (290 m.).
Landing run 385 ft. (117 m.).

THE PIPER PA-18 SUPER CUB 135.
U.S. Army designation: L-21.

The Super Cub 125 is identical to the previously-described model except that it is fitted with a 135 h.p. Lycoming O-290-D engine and has wing flaps.

Both versions of the Super Cub may be fitted with tandem wheels for operation on or off rough ground; and a range of optional equipment is available including electrical system, radio, wood or metal airscrew, extra fuel tank, etc.

DIMENSIONS.—
Same as for Super Cub 95 except:
Length 22 ft. 6 in. (6.86 m.).
WEIGHTS AND LOADINGS.—
Weight empty 895 lb. (406 kg.).
Disposable load 605 lb. (275 kg.).
Weight loaded 1,500 lb. (680 kg.).



The Piper L-21A, the military liaison version of the Super Cub 135. (*Gordon Williams*).



The Piper PA-18-A Agricultural Duster and Sprayer

Wing loading 8.4 lb./sq. ft. (50 kg./m.²).
Power loading 12 lb./h.p. (5.45 kg./h.p.).
PERFORMANCE.—
Max. speed 127 m.p.h. (203 km.h.).
Cruising speed (75% power) 112 m.p.h. (179 km.h.).
Stalling speed (with flaps) 38 m.p.h. (61 km.h.).
Best rate of climb 1,050 ft./min. (320 m./min.).
Service ceiling 20,500 ft. (6,250 m.).
Take-off run 200 ft. (61 m.).
Take-off distance to 50 ft. (15.25 m.) 500 ft. (152.5 m.).
Landing run 300 ft. (91.5 m.).
Cruising range 500 miles (800 km.).

THE PIPER PA-18-A.

This version of the PA-18 is primarily an agricultural sprayer/duster, but it is adaptable for normal uses. It is quantity produced with Piper designed and installed agricultural dispersal equipment as an integral part of the aircraft.

The fuselage has been modified to accommodate an 18 cub. ft. aluminium tank which has a capacity for 110 U.S. gallons of liquid or from 500 to 1,000 lb. of solids, depending on the specific gravity of material used. Every unit has a maximum output of 35 gallons per minute and a pressure range of from 10 to 110 lb., depending on the nozzle orifice and pressure regulator setting.

For dust distribution, an agitator in the hopper and, below the fuselage, a slotted venturi with double gates and lateral dispersal plates ensure uniform flow over a 50 ft. swath.

The normal spray booms are fitted with 24 diaphragm type nozzles which give instant positive shut-off. The booms are hinged to fold back and up about 80° to reduce impact loads if they hit an obstacle.

A new Piper high-density sprayer is also available which will permit the application of from 1 to 10 gallons per acre for a full 50 ft. swath, or 10 to 15 gallons if the swath is cut to 33 ft. This equipment incorporates 46 nozzles on the boom, a new large Simplex pump mounted under the nose cowling and larger outlet and return pipes from the tank to the pump. This high-density unit was designed primarily for de-foliating irrigated cotton and now has many new uses.

Safety features include sharpened leading-edges on the landing-gear struts to cut wires, etc., heavy duty safety belt and shoulder harness for the pilot, etc.

DIMENSIONS.—
As Super-Cub 125.
WEIGHTS AND LOADINGS (Sprayer or Duster).
Weight empty 960 lb. (436 kg.).
Disposable load 1,110 lb. (504 kg.).
Weight loaded 2,070 lb. (940 kg.).
Wing loading 11.6 lb./sq. ft. (56.6 kg./m.²)
Power loading 16.6 lb./h.p. (7.53 kg./h.p.).
PERFORMANCE (at 2,070 lb.=940 kg. A.U.W.).—
Max. speed 108 m.p.h. (173 km.h.).
Cruising speed (75% power) 95 m.p.h. (152 km.h.).
Stalling speed (flaps down) 45 m.p.h. (72 km.h.).
Rate of climb 680 ft./min. (207 m./min.).
Service ceiling 13,800 ft. (4,210 m.).
Cruising range 220 miles (352 km.).
Take-off distance to 50 ft. (15.2 m.) 950 ft. (290 m.).
Landing distance from 50 ft. (15.2 m.) 875 ft. (267 m.).

THE PIPER PA-20 PACER.

TYPE.—Four-seat Cabin monoplane.
WINGS.—High-wing braced monoplane. Wing structure consists of two I-section aluminium spars, riveted Nicral ribs and a covering of Duraclad, a non-inflammable Butyrate-plastic-treated fabric of high-gloss finish. Flaps inboard of ailerons. Wing area 147.5 sq. ft. (13.7 m.²).
FUSELAGE.—Rectangular welded steel-tube structure covered with Duraclad.
TAIL UNIT.—Braced monoplane type. Same structure as for PA-18.
LANDING GEAR.—Fixed divided type. Two side Vees and half axles hinged to centre-line of underside of fuselage. Rubber cord springing. Hydraulic wheel brakes. Steerable full-swivelling tail-wheel. Certified for floats and skis.



The Piper PA-20 Pacer 135 and PA-22 Tri-Pacer 135, both powered by a 135 h.p. Lycoming O-290 engine.

POWER PLANT.—One 135 h.p. Lycoming O-290-D2 four-cylinder horizontally-opposed air-cooled engine. Two-blade Aeromatic or Sensenich controllable-pitch airscrew. Fuel capacity 36 U.S. gallons (136 litres).

ACCOMMODATION.—Cabin seats four in two pairs with dual controls to front pair. Front and rear doors, front door on starboard side and rear door on port side. Soundproofing, cabin heating and temperature control. Ultra-violet-absorbing Plexiglas windows. Large baggage compartment. Cabin equipment varies according to model. Narco two-way VHF and LF radio or automatic direction-finding and omni equipment in Custom model.

DIMENSIONS.—
Span 29 ft. 4 in. (8.9 m.).
Length 20 ft. 4 in. (6.2 m.).
Height 6 ft. 2½ in. (1.98 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,005 lb. (456 kg.).
Weight loaded 1,950 lb. (885 kg.).
Wing loading 13.2 lb./sq. ft. (64.4 kg./m.²).
Power loading 14.4 lb./h.p. (6.53 kg./h.p.).

PERFORMANCE.—
Max. speed 139 m.p.h. (222 km.h.).
Cruising speed (75% power) 134 m.p.h. (214 km.h.) at 7,000 ft. (2,135 m.).
Initial rate of climb 800 ft./min. (244 m./min.).
Service ceiling 15,500 ft. (4,575 m.).
Absolute ceiling 17,500 ft. (5,340 m.).
Cruising range 580 miles (930 km.).

THE PIPER PA-22 TRI-PACER.

The Tri-Pacer is a special version of the PA-20 with a nose wheel landing-gear. It also has interconnected rudder and aileron controls so that the aircraft can be flown by wheel or rudder pedals alone. The linkage, however is such that the rudder, ailerons and elevator may be used independently when required.



The Piper PA-22 Tri-Pacer (135 h.p. Lycoming O-290 engine).

The tricycle landing-gear is not interchangeable with the standard Pacer tail-wheel gear as the fuselage of the Tri-Pacer incorporates modifications to permit the fitting of the nose-wheel and the mounting of the main legs further aft. The steerable nose-wheel is inter-connected with the rudder for ground steering.

The specification of the Tri-Pacer is, except for the features already mentioned, similar to that of the standard PA-20 Pacer.

DIMENSIONS.
Same as for PA-20 Pacer.

WEIGHTS.—
Weight empty 1,040 lb. (472 kg.).
Weight loaded 1,950 lb. (885 kg.).

PERFORMANCE.—
Max. speed 137 m.p.h. (219 km.h.).
Cruising speed (75% power) 132 m.p.h. (211 km.h.) at 7,000 ft. (2,135 m.).
Initial rate of climb 800 ft./min. (244 m./min.).
Service ceiling 15,000 ft. (4,575 m.).
Absolute ceiling 17,500 ft. (5,340 m.).
Cruising range 580 miles (930 km.).

RAWDON

RAWDON BROTHERS AIRCRAFT, INC.

HEAD OFFICE AND WORKS: P.O. BOX 1119, WICHITA, KANSAS.

Rawdon Bros. Aircraft, Inc. has designed and built the T-1 two-seat monoplane, which is suitable for training, touring, crop-spraying, etc. It also manufactures aircraft spraying and dusting equipment, accessories, etc. and operates overhaul and maintenance shops.

THE RAWDON T-1.

TYPE.—Two-seat Training and Crop Spraying monoplane.

WINGS.—Low-wing semi-cantilever monoplane. Modified Göttingen 398 wing section. Chord 5 ft. 2 in. (1.57 m.). Dihedral 4° 30′. Metal structure with fabric covering. Single steel-tube struts in plane of the main spar brace landing-gear attachment points to steel-tube pylon, between two seats. Steel-tube-framed ailerons and flaps are fabric covered. Gross wing area 166 sq. ft. (15.5 m.²).

FUSELAGE.—Welded steel-tube structure covered with fabric over wooden formers.

TAIL UNIT.—Braced monoplane type. Welded steel-tube frames covered with fabric. Statically-balanced rudder and elevators. Plywood-covered trim-tabs in both elevators.

LANDING GEAR.—Fixed tail-wheel type. Consists of two vertical welded steel-tube frames braced to wing spar on both sides by sloping struts. Rawdon oleo-spring shock-absorbers hinged at their lower extremities by torque links. Goodyear wheels and hydraulic disc brakes. Full swivelling and steerable tail-wheel on Maule oleo-spring strut. Track 9 ft. 11 in. (3 m.).

POWER PLANT.—One 135 h.p. Lycoming 0-290-D2 four-cylinder horizontally-opposed air-cooled engine. Sensenich metal airscrew. Two Goodyear Pliocel flexible fuel tanks in wing roots. Total fuel capacity 38 U.S. gallons (144 litres).



The Rawdon T-1 (135 h.p. Lycoming O-290 engine).

ACCOMMODATION.—Tandem seats with dual controls under transparent canopy. Upper panels over seats hinge to right side for access and exit. Vertically sliding lower side panels. Baggage compartment aft of rear seat.

EQUIPMENT.—For crop-spraying, T-1 is fitted with spray manifolds entirely within wings with nozzles projecting about 5 in. Spray tank (80 U.S. gallon = 300 litres) installed in rear cockpit. Engine-driven pump. All spray equipment, except manifolds, quickly removable.

DIMENSIONS.—
Span 33 ft. 4 in. (10.16 m.).
Length 24 ft. 2 in. (7.52 m.).
Height 7 ft. 3 in. (2.21 m.).

WEIGHTS AND LOADINGS.
Weight empty 1,225 lb. (656 kg.).
Crew (2) 380 lb. (172.5 kg.).
Fuel and oil 195 lb. (88.5 kg.).
Weight loaded 1,800 lb. (817 kg.).
Wing loading 10.7 lb./sq. ft. (55.2 kg./m.²).
Power loading 14.4 lb./h.p. (6.53 kg./h.p.).

PERFORMANCE.—
Max. speed 134 m.p.h. (214 km.h.).
Cruising speed 120 m.p.h. (192 km.h.).
Landing speed (with flaps) 50 m.p.h. (80 km.h.).
Initial rate of climb 815 ft./min. (248.5 m./min.).
Service ceiling 18,000 ft. (5,490 m.).
Cruising range 550 miles (880 km.).
Take-off to clear 50 ft. (15.25 m.) with 12° flap 700 ft. (213.5 m.).
Landing distance from 50 ft. (15.25 m.) with 30° flap 600 ft. (183 m.).

REGENT

REGENT AIRCRAFT, INC.

HEAD OFFICE AND WORKS: MUNICIPAL AIRPORT, EDINBURG, TEXAS.

General Manager and Chief Designer: R. S. Johnson.

In 1953 Regent Aircraft, Inc. moved from Pearland to Edinburg, Texas, where land for the erection of a factory for the production of the Regent Rocket was presented to the company by the city of Edinburg. Immediate plans call for the production of the Rocket 260 and the completion of development of the Rocket 400, on which production will begin as



The Regent Rocket 260 (260 h.p. Lycoming GSO-435 engine).

soon as tests are completed. The two models are similar in outward appearance and construction and differ mainly in power-plant fitted.

THE REGENT ROCKET 260.

TYPE.—Five-seat cabin monoplane.

WINGS.—Low-wing cantilever monoplane. All-metal structure. Hydraulically-operated split-flaps inboard of ailerons. Total area of flaps (aft of hinge line) 17.8 sq. ft. (1.65 m.²). Total area of ailerons (aft of hinge line) 15.25 sq. ft. (1.42 m.²). Gross wing area 154 sq. ft. (14.41 m.²).

FUSELAGE.—All-metal monocoque structure.

TAIL UNIT.—Cantilever all-metal monoplane type. Adjustable tailplane. Areas: fin (to rudder hinge) 9.1 sq. ft. (0.84 m.²), rudder (aft of hinge line) 9.9 sq. ft. (0.92 m.²), tailplane (to elevator hinge) 13.7 sq. ft. (1.27 m.²), elevators (aft of hinge line) 12.6 sq. ft. (1.17 m.²).

LANDING GEAR.—Retractable nose-wheel type. Hydraulic retraction. Regent design hydraulic shock-absorber struts and wheels. Goodrich tyres. Hydraulic brakes. Track 9 ft. (2.74 m.).

POWER PLANT.—One 260 h.p. Lycoming GSO-435-C2 six-cylinder horizontally-opposed air-cooled geared and super charged engine. Hartzell Hydro-selective constant-speed airscrew. Two main fuel tanks in wings and one reserve tank in fuselage. Total normal fuel capacity 65 U.S. gallons (246 litres). Oil capacity 3 U.S. gallons (11.3 litres).

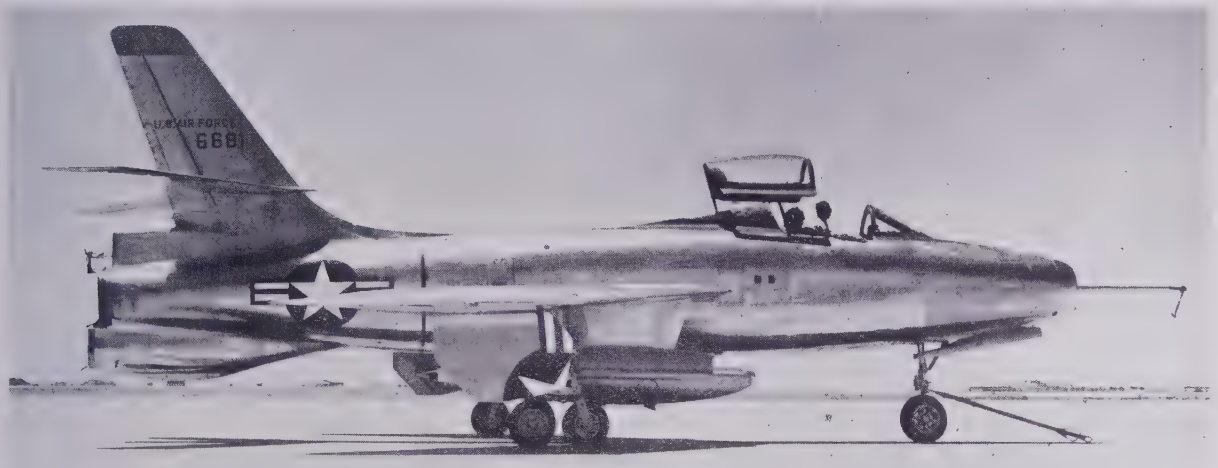
ACCOMMODATION.—Cabin seats five, two side-by-side in front, with dual controls, and three behind.

DIMENSIONS.—
Span 30 ft. 6 in. (9.30 m.).
Length 26 ft. 3 in. (8.00 m.).
Height 9 ft. 10 in. (3.00 m.).

WEIGHTS.—
Weight loaded 2,900 lb. (1,316 kg.).

PERFORMANCE.—
Cruising speed at S/L. 190 m.p.h. (304 km.h.).
Cruising speed at optimum height 200 m.p.h. (320 km.h.).
Landing speed below 60 m.p.h. (96 km.h.).
Endurance at economic cruising speed 5 hours.
Take-off distance to clear 50 ft. (15.25 m.) 1,000 ft. (305 m.).

REPUBLIC



The Republic XF-91 Experimental Interceptor Fighter with both jet and rocket power. (*Gordon Williams*).

THE REPUBLIC AVIATION CORPORATION.

HEAD OFFICE AND WORKS: FARMINGDALE, LONG ISLAND, N.Y.

President and General Manager: Mundy I. Peale.

Vice-President in Charge of Engineering: Alexander Kartveli.

Vice-President in charge of Industrial Relations: John J. Ryan.

Vice-President in charge of Sales: L. L. Brabham.

Vice-President and Assistant General Manager: Tom Murphy.

Vice-President: Martin F. Scanlon.

Secretary and Treasurer: T. Davis.

Production facilities of the Republic Aviation Corporation are devoted entirely to the production of military aircraft.

Production of the F-84 Thunderjet came to an end on July 27, 1953, with the delivery of the 4,457th and last to the U.S.A.F. In addition to its widespread service with the U.S.A.F., the Thunderjet has been supplied under the Mutual Defence Assistance Plan to France, Belgium, the Netherlands, Norway, Italy, Greece, Denmark, Portugal, Turkey, Yugoslavia and Formosa.

The new swept-wing F-84F Thunderstreak is now in large-scale production.

Republic has engineering projects in various stages of design and development for other types of advanced aircraft and equipment for military use, details of which cannot be revealed.

REPUBLIC F-105.

Republic has been awarded a U.S.A.F. contract for the development of a delta-wing fighter which has been given the designation F-105. No further details are available.

THE REPUBLIC F-103.

A contract is also held for the production of a supersonic fighter development of the XF-91 to be known as the F-103. No further details are available.

THE REPUBLIC XF-91.

The XF-91, of which two prototypes have been built, is an experimental high-speed interceptor fighter with a mixed power-plant consisting of a General Electric J47 turbojet engine with afterburner and an auxiliary Reaction Motors XLR-11-RM-9 rocket power-unit. The four rocket tubes of this unit are disposed two above and two below the jet tail-pipe exit. The first XF-91 prototype flew for the first time, on jet power alone, on May 9, 1949.

The XF-91 has variable-incidence swept-back wings with inverse taper and thickness, the wings having greater chord and depth at the tips than at the fuselage intersection. It is claimed the inverse taper combined with leading-edge slots reduces wing-tip stalling at low speeds.

The landing-gear incorporates tandem-wheel main units which retract outwardly into the thicker and wider portions of the wings near the tips.

In December, 1952, at the Edwards A.F.B., Muroc, Cal., the XF-91 with all the jet and rocket power at its disposal exceeded Mach. 1 and was thus the first American combat-type fighter to fly faster than sound in level flight.

DIMENSIONS.—
Span 31 ft. 3 in. (9.53 m.).
Length 43 ft. 3 in. (13.19 m.).
Height 18 ft. 1 in. (5.52 m.).

WEIGHTS AND PERFORMANCE.—
No data available.



The Republic F-84F Thunderstreak Single-seat Fighter (Wright J65 turbojet engine).



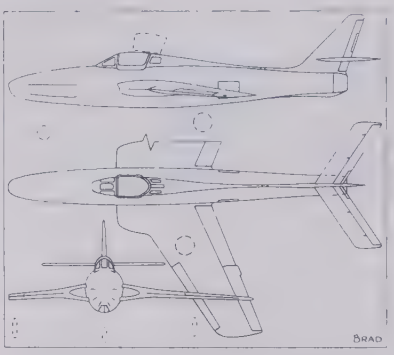
The Republic F-84F Thunderstreak Single-seat Fighter (Wright J65 turbojet engine).

THE REPUBLIC THUNDERSTREAK.
U.S.A.F. designations: F-84F and RF-84F.

This aircraft was originally intended to be a swept-wing version of the F-84E Thunderjet to be powered with an Allison J35-A-29 engine (5,800 lb. = 2,630 kg. s.t.). It was also proposed to redesignate this production aircraft the YF-96A. A prototype XF-84F using an F-84E fuselage, but fitted with an Allison J35-A-25 engine (5,200 lb. = 2,360 kg. s.t.) was engineered, built and flown in six months, its first flight being made on June 3, 1950.

The impending availability of the high-powered Sapphire engine (7,200 lb. = 3,270 kg. s.t.), for which Curtiss-Wright had acquired a manufacturing licence, resulted in the decision to re-engine the F-84F and a prototype fitted with an imported British-built Sapphire flew for the first time on February 14, 1951. As the result of successful trials this version, to be powered with the Wright J65 Sapphire engine, was selected for large-scale production.

The new power-plant, with its larger dimensions and greater power, has called for a considerable number of design and production changes with the result that, compared with the F-84E, the swept-wing F-84F is almost entirely a new aeroplane.



The Republic RF-84F Thunderstreak.

Both wings and tail of the F-84F have a sweepback of 40° at 25 per cent. of the chord. The new wings incorporate a high proportion of press forgings in place of built-up components in their structure, and they are now fitted with leading-edge auto slats.

Other new features of the F-84F are an upward-hinged canopy; perforated air-brakes hinged to the fuselage sides aft of the wing trailing-edge; in-flight refuelling equipment with the inlet nozzle in the upper surface of the port wing; and an irreversible power-boosted control system. In the first production aircraft the all-swept tail has both adjustable tail surfaces and elevators, but it is intended to incorporate a one-piece "flying" tail in later versions.

The F-84F has the standard F-84 armament of six .50-in. machine-guns, four in the fuselage and one in each wing, but it will carry heavier loads of external stores and fuel than its predecessors. Such stores may include twenty-four 5-in. rockets, or four 1,000-lb. bombs, or two 230 U.S. gallon (870 litre) drop tanks plus various combinations of offensive stores. For long-range escort fighter duties two 450 U.S. gallon (1,700 litre) external tanks may be carried.

A photographic reconnaissance version of the Thunderstreak, the RF-84F, has the air intake removed to the wing roots to permit the installation of camera equipment in the slightly elongated nose. This version has an armament of four .50-in. machine-guns, two in each wing outboard of the air intakes.

The first production F-84F was delivered to the U.S.A.F. on December 3, 1952.

DIMENSIONS.—
Span 33 ft. 7 in. (10.25 m.).
Length 41 ft. 9 in. (12.73 m.).
Height 14 ft. 4 in. (4.37 m.).

WEIGHTS AND PERFORMANCE.—
No data available.



The Republic F-84E Thunderjet Single-seat Fighter (Allison J35 turbojet engine).



The Republic F-84G Thunderjet, the first operational fighter aircraft to be equipped for air-to-air refuelling.

THE REPUBLIC THUNDERJET.
U.S. Air Force designation: F-84.

The Thunderjet was developed under the joint supervision of the Republic company and the U.S.A.A.F. Air Material command. The first prototype XF-84 flew on February 28, 1946.

F-84A. Differed from XF-84 in brake, armament and other minor details. Thirteen YF-84A's built but converted to F-84B.

F-84B. First production model. Armament increased to six .5 in. (12.7 mm.) guns. Air conditioned cockpit. Provision for R.P. in 86th and subsequent aircraft, with retractable R.P. mounts.

F-84D. Development of F-84B. Thicker metal skins on wings and ailerons, hinged gun deck, winterised fuel system, changes to permit use of gasoline instead of kerosene and substitution of mechanical linkage for hydraulic compression of shock-strut travel to shorten landing-gear for retraction.

F-84E. Fitted with Allison J35-A-17 engine rated at 5,000 lb. (2,270 kg.) s.t. Longer fuselage to give more room in cockpit. wing-tip tanks fitted with fins to permit full manoeuvrability with tanks fitted, structural modifications to increase permissible G loads, and other improvements to simplify maintenance. Addition of two 230 U.S. gallon drop tanks on bomb shackles beneath wings inboard of landing-gear increases combat radius to over 1,000 miles (1,600 km.). In addition to fixed armament, F-84E can carry 32 5-in. rockets; or two 11.5-in. and 16 5-in. rockets; or two 1,000-lb. bombs and 18 5-in. rockets or other various combinations of expendable stores. Provision for four 1,000-lb. Jato units for accelerated take-off. First F-84 version to be supplied under M.D.A.P. to nations participating in the North Atlantic Treaty Organization.

F-84G. Progressive development of F-84E. Fitted with in-flight refuelling equipment with wing receptacle in port wing for use with the Boeing "flying-boom" system. Automatic pilot fitted. Allison J35-A-29 engine rated at 5,600 lb. = 2,540 kg. s.t., or 10 per cent. more than F-84E power-plant. Replaced F-84E in production and was delivered to U.S.A.F. and nations participating in the N.A.T.O. Under test an F-84G has remained in the air for 12 hours 5 minutes. receiving four aerial fuelings during the flight. First U.S.A.F. fighter to be equipped with in-flight refuelling equipment. Of the U.S.A.F. F-84G Thunderjets assigned overseas, 631 were flown across the Atlantic and 135 across the Pacific with the aid of flight refuelling. The F-84G was also the first U.S.A.F. fighter-bomber announced as being equipped to carry the atomic bomb. Withdrawn from production in July, 1953.

XF-84H. An experimental aircraft which will be powered with an Allison T54 turboprop engine and an Aeroproducts six-blade co-axial contra-rotating high-speed small-diameter airscrew, as part of an Air Force supersonic airscrew flight test programme. The XF-84H is not expected to fly until mid-1954.

The description below refers specifically to the F-84E.

TYPE.—Single-seat Jet Fighter.

WINGS.—Low mid-wing cantilever monoplane. Republic high-speed laminar-flow wing-section. Dihedral 5°. All-metal structure with flush-riveted stressed-skin. Flaps between ailerons and fuselage. Root chord 9 ft. 2¼ in. (2.8 m.), tip chord 5 ft. 3 in. (1.6 m.).

FUSELAGE.—Circular section structure. All-metal construction with flush-riveted stressed skin.

TAIL UNIT.—Cantilever monoplane type. Tailplane dihedral 5°. Trim-tabs in elevators and rudder. Tailplane span 14 ft. 11½ in. (4.5 m.).

LANDING GEAR.—Retractable tricycle type. Hydraulic retraction. Track 16 ft. 6 in. (5.03 m.).

POWER PLANT.—One Allison J35-A-17 axial-flow turbojet engine in fuselage aft of wings with nose air inlet and tail exhaust exit. Rear section of fuselage removable for access to engine compartment and to permit complete replacement of engine in 50 minutes. Main fuel tankage in wings. External tanks may be carried on bomb-shackles at wing roots and at wing tips.

ACCOMMODATION.—Pilot's pressurised cockpit ahead of wing leading-edge. Electrically-operated jettisonable bubble canopy. Pilot's ejector seat.

ARMAMENT.—Six .50 in. (12.7 mm.) machine-guns, four in nose of fuselage and two in wings, one on each side of fuselage. Provisions for carrying rocket or bomb loads or various combinations of each up to a maximum weight of 4,500 lb. (2,045 kg.).

DIMENSIONS.—
Span 36 ft. (10.9 m.).
Length 38 ft. (11.6 m.).
Height 12 ft. 10½ in. (3.9 m.).

WEIGHTS.—
Weight empty over 11,000 lb. (4,995 kg.).
Max. gross weight 18,000 lb. (8,172 kg.).

PERFORMANCE.—
Max. speed over 600 m.p.h. (960 km.h.) at sea level.
Service ceiling, over 45,000 ft. (13,725 m.).
Combat radius 850 miles (1,360 km.).
Combat radius (with four external fuel tanks) 1,000 miles (1,600 km.).

RYAN

THE RYAN AERONAUTICAL COMPANY.

HEAD OFFICE AND WORKS: LINDBERGH FIELD, SAN DIEGO 12, CALIFORNIA.

President: T. Claude Ryan.

Executive Vice-President: G. C. Woodard.

Vice-President: Earl D. Prudden.

Director of Engineering: Bruce Smith.

Works Manager: L. M. Limbach.

Secretary and Treasurer: C. A. Stillwagen.

Sales and Export Manager: Sam C. Breder.

The Ryan Aeronautical Company is a successor to the old Ryan Company which produced the aeroplane in which Mr. Charles Lindbergh made the first non-stop flight from New York to Paris in 1927.

In the Summer of 1947, the Ryan company acquired the design and manufacturing rights of the Navion four-seat all-metal light cabin monoplane from North American Aviation, Inc. Over 1,000 civil Navions were built during the years 1948-50, but production was suspended in 1951 to enable the company to devote its entire activities to the Defense Programme.

The current activities of the Ryan Aeronautical Company are diversified and fall into three main groups:— (*a*) research and development in and the manufacture of aircraft and aeronautical products of the company's own design; (*b*) production of airframe components for other manufacturers; and (*c*) the production of high-temperature parts for aircraft engines.

Important aeronautical research programmes, including production of the Ryan Firebee pilotless jet-powered target aircraft, are being conducted for the Air Force, Army and Navy. Prime contracts are held for the development of guidance systems for missiles and other electronic devices of Ryan design.

Among airframe components of Ryan design being manufactured in volume are external fuel tanks, including the largest known to be in production anywhere.

For aircraft engines Ryan builds heat and corrosion-resistant stainless-steel components, and applies ceramic coatings for jet engines, piston engines and rocket motors. Products include such items as

exhaust cones, tail pipes, combustion chambers, afterburners and exhaust nozzles for jet engines, exhaust systems for aircraft piston engines, and complete rocket motors for guided missiles.

THE RYAN FIREBEE.

The Firebee is a pilotless remotely-controlled high-speed turbojet-powered target drone which has been developed under a joint Air Force/Army/Navy project, with the U.S.A.F. Air Research and Development Command having technical cognizance of its development.

Early in 1953 Army Ordnance placed the first military contract for the Ryan Firebee. These targets, officially designated XM21, will be put into operation at the Army Ordnance Proving Ground at White Sands, N.M., and at Fort Bliss, Texas, where they will be used in training Army troops in the operation of the "Skysweeper" gun and various guided missiles.

The Firebee is an all-metal mid-wing monoplane with swept-back wings and tail surfaces. It has a span of approximately 12 ft. (3.66 m.) and is about 18 ft. (5.49 m.) long. It is powered by a Fairchild J44 turbojet engine (1,000 lb.= 454 kg. s.t.) which is mounted in a nacelle which forms the lower part of the forward fuselage and exhausts below the rear fuselage. The Firebee has also been tested with the Turboméca Marboré II, which will be manufactured by Continental Motors under the designation J-69.

To achieve the most economical use of the drone, a two-stage parachute system has been developed to decelerate the drone from its near-sonic operating speed and to lower it safely to the ground without damage to the aircraft structure or its delicate electronic controls.

The recovery system is also capable of lowering the drone to the ground automatically in the event of a target hit, loss of radio wave carrier from the remote-control station, engine failure, or upon command by the remote control operator. To prevent damage by dragging, the recovery system incorporates a disconnect system which releases the parachute from the drone upon contact with the ground.

The Firebee is composed of five major assemblies—fuselage, engine nacelle, wing, tail-unit and parachute container. Construction is of aluminium, magnesium and stainless-steel. The wing and tail-unit are attached to the fuselage by four self-aligning bolts. The engine nacelle is hinged to give ready access to the interior of the compartment.



The Ryan Firebee Target Drone (Fairchild J44 turbojet engine).

The development and design of the Firebee by Ryan also involved the complete development of the remote control system, the autopilot system and the parachute recovery system.

Glide flight tests of the Firebee without power were begun in March, 1951, and the first powered flights were made that Summer at the U.S.A.F. Holloman Air Development Center, Alamogordo, New Mexico. In the subsequent test programme the Firebee was launched from under the wings and from the bomb-bay of a Douglas B-26 carrier.

The Army XM21 is ground-launched from a 60-foot rail with the aid of a booster rocket, which is jettisoned after the target's jet engine has taken over.

RILEY

RILEY AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: FORT LAUDERDALE, FLORIDA.

President: Jack Riley.

The Riley Aircraft Company has converted the single-engined Ryan Navion into a twin-engined aircraft with such success that the company, unable to meet the demand for conversion, has contracted with the Temco Aircraft Corporation of Dallas, Texas, to produce 100 Twin-Navions on their behalf in the next twelve months. Riley remains responsible for all sales, engineering and tooling in connection with this contract. As there are well over 2,000 single-engined Navions flying to-day there is ample basic material for this interesting conversion.

THE RILEY TWIN-NAVION.

The Twin-Navion is a conversion of the well-known four-seat Navion into a twin-engined aircraft. The first conversion was completed by Riley in April, 1952. The type has received its Approved Type Certificate and it is now being produced by both Riley and Temco on a production line basis.

Conversion includes installing two Lycoming engines in wing nacelles; reinforcing the original wing to support the engine nacelles; fitting a new and larger tail unit, a new nose to the fuselage in place of the original engine, a new instrument panel and control pedestal, while there are many other changes in furnishings and equipment.



The Riley Twin-Navion (two 140 h.p. Lycoming O-290 engines). (*Howard Levy*).

The first twenty Twin-Navions are being powered by two 140 h.p. Lycoming O-290D-2A engines, but these engines will be replaced by two 150 h.p. Lycoming O-320 engines when they become available.

DIMENSIONS.
Span 33 ft. 4½ in. (10.18 m.).
Length 27 ft. 2 in. (8.28 m.).
Height 10 ft. 4 in. (3.15 m.).
Wing area 178 sq. ft. (16.5 m.²).

WEIGHTS.—
Weight empty 2,100 lb. (953 kg.).
Weight loaded 2,950 lb. (1,340 kg.).

PERFORMANCE.
Max. speed 178 m.p.h. (285 km.h.).
Cruising speed 168 m.p.h. (269 km.h.).
Landing speed 60-65 m.p.h. (96-104 km.h.).
Initial rate of climb 1,400 ft./min. (427 m./min.).
Service ceiling 21,000 ft. (6,400 m.).
Range 720 miles (1,150 km.).
Take-off distance to clear 50 ft. (15.25 m.) 700 ft. (213.5 m.).
Landing distance from 50 ft. (15.25 m.) 650 ft. (198m.).

SCHWEIZER

SCHWEIZER AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: COUNTY AIRPORT, ELMIRA, N.Y.

President and Chief Engineer Ernest Schweizer.

Vice-President and General Manager: Paul A. Schweizer.

Vice-President in charge of Manufacturing: William Schweizer.

Treasurer: Nicolas Haich.

Secretary: Robert P. McDowell.

The Schweizer Aircraft Corpn. specialises in the design and construction of gliders and sailplanes. It also manufactures parts and assemblies for other aircraft companies under sub-contract. The company furthermore maintains a complete aircraft and glider overhaul and repair service.

In 1951-52 Schweizer was engaged almost exclusively on the manufacture of aircraft components for the defense programme. It is, however, continuing experimental work on gliders and sailplanes.

The latest sailplane products of the Schweizer Corporation are the SGS 1-23 and 1-23D High-Performance Sailplanes, description of which follow. The SGS 1-23D was first flown in March, 1953.

THE SCHWEIZER SGS 1-23 SAILPLANE.

The SGS 1-23 was first flown at the 1948 National Soaring Contest at Elmira, N.Y. It is of all-metal construction in the fullest sense of the term, there being no fabric covering at all.

On December 30, 1950, William Ivans set a new World's Height Record when he soared his 1-23 to an absolute altitude of 42,100 ft. (12,840 m.) above sea level at Bishop, California. He gained 30,100 ft. (9,180 m.) above his release from aeroplane tow. This flight was made by using

the famous "standing wave" caused by winds blowing in from the Pacific over the top of the Sierra Nevada Mountains, dipping into the Owens Valley and sweeping up again over the White Mountains.

In August, 1951, Howard Klitgord flew a distance of 350 miles (560 km.), from Odessa, Texas, into Oklahoma in an SGS 1-23.

In August, 1952, William Coverdale made a World's out and return record of 268 miles (416.8 km.) in an SGS 1-23.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Mid-wing cantilever monoplane. Aspect ratio 12.88. All-metal structure. Aileron area (total) 16.64 sq. ft. (1.545 m.²). Spoiler area (total) 5.00 sq. ft. (0.464 m.²). Gross wing area 149 sq. ft. (13.84 m.²).

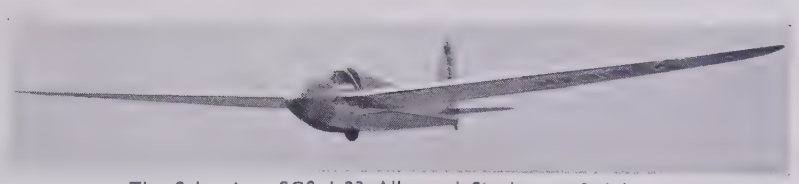
FUSELAGE.—All-metal monocoque.

TAIL UNIT.—Cantilever monoplane type. All-metal structure including covering. Tailplane span 7 ft. (2.13 m.). Horizontal tail surface area 15.13 sq. ft. (1.405 m.²). Vertical tail surface area 9.11 sq. ft. (0.846 m.²).

ACCOMMODATION. — Pilot's cockpit with moulded Plexiglas canopy. Fully equipped instrument panel. Room behind pilot for radio, baragraph and oxygen equipment.

DIMENSIONS.—
Span 43 ft. 10 in. (13.36 m.).
Length 20 ft. 4 in. (6.20 m.).
Height 6 ft. 10 in. (2.08 m.).

WEIGHTS AND LOADINGS.—
Weight empty 385 lb. (175 kg.).
Pilot 170 lb. (77 kg.).
Extra equipment 45 lb. (20.5 kg.).
Weight loaded 600 lb. (272.5 kg.).
Max. permissible loaded weight 660 lb. (300 kg.).



The Schweizer SGS 1-23 All-metal Single-seat Sailplane.

Wing loading 4.02 lb./sq. ft. (19.62 kg./m.²)

PERFORMANCE.—
Designed max. speed 123 m.p.h. (196.8 km.h.).
Cruising speed 75 m.p.h. (120 km.h.).
Min. sinking speed 2.35 ft./sec. (0.72 m./sec.).
Glide or Dive Placard speed 110 m.p.h. (176 km.h.).
Auto towing speed 70 m.p.h. (112 km.h.)
Aeroplane towing speed 90 m.p.h. (144 km.h.).

THE SCHWEIZER SGS 1-23D SAILPLANE.

The SGS 1-23D, which was first flown in March, 1953, has the same type of construction as the 1-23 but has wings of higher aspect ratio for increased performance.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Mid-wing cantilever monoplane. Aspect ratio 15.58. All-metal structure. Aileron area (total) 19.40 sq. ft. (1.80 m.²). Spoiler area (total) 5.000 sq. ft. (0.464 m.²). Gross wing area 160.6 sq. ft. (14.92 m.²).

FUSELAGE.—All-metal monocoque.

TAIL UNIT.—Same as for 1-23 except vertical tail surface area 10.61 sq. ft. (0.98 m.²).

ACCOMMODATION.—Same as for 1-23.

DIMENSIONS.—
Span 50 ft. (15.25 m.).
Length 20 ft. 9 in. (6.33 m.).
Height 6 ft. 10 in. (2.08 m.).

WEIGHTS AND LOADING (Flight Condition 1).—
Weight empty 430 lb. (195 kg.).
Pilot 170 lb. (77 kg.).
Weight loaded 60 lb. (272 kg.).
Wing loading 3.74 lb./sq. ft. (18.15 kg./m.²).

WEIGHTS AND LOADING (Flight Condition 2).—
Weight empty 430 lb. (195 kg.).
Pilot 190 lb. (86 kg.).
Extra equipment 80 lb. (36 kg.).
Weight loaded 700 lb. (317 kg.).
Wing loading 4.36 lb./sq. ft. (21.27 kg./m.²).
Max. permissible loaded weight 750 lb. (340.5 kg.).

PERFORMANCE.—
Designed max. speed 132 m.p.h. (211 km.h.).
Cruising speed (Condition 1) 78 m.p.h. (125 km.h.).
Cruising speed (Condition 2) 85 m.p.h. (136 km.h.).
Min. sinking speed (Condition 1) 2.00 ft./sec. (0.61 m./sec.).
Min. sinking speed (Condition 2) 2.16 ft./sec. (0.66 m./sec.).
Glide or dive placard speed 119 m.p.h. (180 km.h.).
Auto towing speed 68 m.p.h. (109 km.h.).
Aeroplane towing speed 110 m.p.h. (176 km.h.).

SEIBEL

HELICOPTER DIVISION, CESSNA AIRCRAFT COMPANY, INC.

HEAD OFFICE AND WORKS: WICHITA, KANSAS.

On March 1, 1952, the Cessna Aircraft Company took over the Seibel Helicopter Company and incorporated it as the Helicopter Division of Cessna.

The Seibel Helicopter Co., Inc. was originally formed by Mr. Charles M. Seibel, who was formerly engaged on helicopter development with the Bell Aircraft Corporation. His first experimental helicopter the S3, was built in 1947 and this was followed by the S4.

The S4-A was certificated by the C.A.A. in 1950 and two were acquired by the U.S. military forces for evaluation. The S4-B, a two-seat side-by-side trainer development of the S4-A, is not certificated.

Neither of these helicopters will be developed further by Cessna, which intends to evolve new models using the simplified helicopter principles which have been thoroughly tested and proved by these two experimental prototypes.



The Seibel S4-A General Purpose Helicopter.

THE SEIBEL S4-A.

U.S.A.F. designation: YH-24.

TYPE.—Two-seat Helicopter.

ROTOR SYSTEM.—Two-blade main rotor and two-blade anti-torque rotor, both having solid laminated wood blades. Blades are attached to cast magnesium hubs by flexible steel sheet L-section hinges which permit continuously varying pitch of the blades without need for pitch-change bearings. Main rotor dimeter 29 ft. 1½ in. (8.8 m.). Anti-torque rotor diameter 5 ft. 7 in. (1.7 m.).



The Seibel S4-B Two-seat Training Helicopter.

FUSELAGE.—Forward portion is a welded steel-tube framework having two decks, the lower deck for the pilot and passenger or alternative load and upper deck for complete power-unit and main rotor assembly. Tail rotor carried on a light alloy tapered tubular member which is attached to rear end of upper deck of forward fuselage.

LANDING GEAR.—Nose wheel fixed type. Main wheels sprung by rubber cord rings. Main wheel track 7 ft. 2 in. (2.5 m.). Wheel base 11 ft. 3 in. (3.4 m.).

POWER PLANT.—One 125 h.p. Lycoming O-290-D four-cylinder horizontally-opposed fan-cooled engine driving main rotor through a set of standard automotive spiral bevel gears with a 6.66 : 1 reduction ratio. Power take-off drives the anti-torque rotor by extension shaft and gearbox. Shaft runs within rear fuselage tube on ball bearings and incorporates two universal joints. Complete power-unit, including engine, accessories, cooling-fan, clutch and free-wheeling unit and cowling may be replaced by two men in 45 minutes. Fuel capacity 19 U.S. gallons (72 litres).

ACCOMMODATION.—Pilot on forward extension of fuselage framework behind windscreen. Passenger or cargo space is aft beneath the upper deck and centre of lift. Load area is unobstructed and accessible from rear.

It measures 6 ft. 7 in. (2 m.) long, 2 ft. 2 in. (0.75 m.) wide, 3 ft. (0.915 m.) high. Floor is 1 ft. (0.305 m.) above the ground.

DIMENSIONS.
Main rotor diameter 29 ft. 1½ in. (8.88 m.)
Length of fuselage 27 ft. 10 in. (8.49 m.).
Overall length (rotor fore and aft) 35 ft. 1 in. (10.70 m.).
Overall width (rotor fore and aft) 7 ft. 11 in (2.41 m.).
Overall height 10 ft. (3.05 m.).
Anti-torque rotor diameter 5 ft. 7 in. (1.7 m.).

WEIGHTS.—
Weight empty 960 lb. (436 kg.).
Weight loaded 1,500 lb. (680 kg.).

PERFORMANCE.
Max. speed 70 m.p.h. (112 km.h.).
Initial rate of climb 713 ft./min. (217 m./min.).
Hovering ceiling 2,400 ft. (730 m.).
Max. ceiling 6,400 ft. (1,950 m.).

THE SEIBEL S4-B.

The S4-B is a two-seat side-by-side trainer development of the S4-A. A new front fuselage and a skid landing-gear are the principal changes. The power-plant now consists of a 165 h.p. Franklin 5A4-165-B3 six-cylinder engine.

WEIGHTS.
Weight empty 1,100 lb. (500 kg.).
Weight loaded 1,650 lb. (750 kg.).

PERFORMANCE.
Max. speed 80 m.p.h. (128 km.h.).
Initial rate of climb 1,300 ft./min. (396 m./min.).
Hovering ceiling 5,500 ft. (1,680 m.).
Max. ceiling 14,000 ft. (4,270 m.).

SIKORSKY

SIKORSKY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: SOUTH AVENUE, BRIDGEPORT, CONN.

General Manager: B. L. Whelan.

Assistant General Manager: R. A. Aspinwall.

Engineering Manager: Igor I. Sikorsky.

Chief Engineer: Michael E. Gluhareff.

Assistant Engineering Manager: Serge E. Gluhareff.

Factory Superintendent: Alex Sperber.

Divisional Controller: Paul W. Holt.

Divisional Auditor: G. L. Wadman.

With the completion of additions at its main plant and the leasing of other space at several locations in Bridgeport, Sikorsky Aircraft was using over half a million square feet of production space at the beginning of 1953.

In production at Bridgeport was the S-55 and its military versions.

The S-51 and S-55 are being produced under license in the United Kingdom by Westland Aircraft, Limited, Yeovil, Somerset, while a licensee agreement for production of the S-55 in France has been signed with the Société Nationale de Constructions Aéronautiques du Sud-Est.

THE SIKORSKY S-51.

U.S. Air Force designation: H-5.
U.S. Navy designation: HO3S-1.

The S-51 was the first Sikorsky helicopter to be licensed by the C.A.A. for commercial operation and went into production in 1946. In addition to its many civil applications the S-51 is also in service with the U.S. Air Force, U.S. Navy, U.S. Coast Guard and the Royal Canadian Air Force for miscellaneous general utility duties.

British Westland-built S-51's are in service in the Royal Air Force and the Royal Navy and have been supplied to many commercial operators.

The S-51 was withdrawn from production in the U.S.A. at the end of 1951, after more than 300 had been built. A full structural description of the S-51 has appeared in previous editions of this Annual.

DIMENSIONS (Composite rotor blades).
Main rotor diam. 48 ft. 0 in. (14.63 m.).
Tail rotor diam. 8 ft. 5 in. (2.56 m.).
Length overall 57 ft. 0½ in. (17.39 m.).
Length with rotor blades removed 41 ft. 1⅞ in. (12.55 m.).
Main rotor disc area 1,810 sq. ft. (168 m.²).

DIMENSIONS (Metal rotor blades).—
Max. rotor diameter 49 ft. (14.94 m.).
Tail rotor diameter 8 ft. 8 in. (2.64 m.).



The Sikorsky HO3S-1 Naval Helicopter (450 h.p. Pratt & Whitney R-985 engine).

Length overall 57 ft. 8 in. (17.58 m.).
Height overall 12 ft. 11 in. (3.93 m.).

WEIGHTS (Composite rotor blades).—
Weight empty 3,795 lb. (1,723 kg.).
Disposable load 1,505 lb. (683 kg.).
Weight loaded 5,300 lb. (2,406 kg.).

WEIGHTS (Metal rotor blades).—
Weight empty 3,805 lb. (1,727 kg.).
Disposable load 1,695 lb. (770 kg.).
Weight loaded 5,500 lb. (2,497 kg.).

PERFORMANCE (Composite rotor blades).—
Max. speed at S.L. 103 m.p.h. (165 km.h.).
Cruising speed (65% power) at 1,000 ft. (305 m.) 85 m.p.h. (136 km.h.).
Minimum flying speed 0 m.p.h. (0 km.h.).
Max. rate of climb at S.L. 1,000 ft./min. (305 m./min.).
Vertical rate of climb at S.L. 200 ft./min. (61 m./min.).
Hovering ceiling without ground effect 3,500 ft. (1,070 m.).
Hovering ceiling with ground effect 5,500 ft. (1,680 m.).
Service ceiling 13,000 ft. (3,965 m.).

PERFORMANCE (Metal rotor blades).—
As above, except:
Hovering ceiling without ground effect 3,100 ft. (945 m.).
Hovering ceiling with ground effect 5,000 ft. (1,525 m.).
Service ceiling 13,500 ft. (4,120 m.).

THE SIKORSKY S-52-2.

U.S. Air Force designation: YH-18.
U.S. Navy designation: HO5S-1

TYPE.—Three/four-seat Utility Helicopter.

ROTORS.—Three-blade main rotor and two-blade tail anti-torque rotor. Main and tail rotor blades of aluminium and steel construction. Main rotor blades are free flapping and full feathering. Cyclic pitch change by wobble plate actuated by conventional pilot's control column. Collective pitch lever synchronised with engine throttle. Pitch of anti-torque tail rotor controlled collectively by rudder pedals.

FUSELAGE.—All metal structure. Aluminium and magnesium alloy semi-monocoque construction except main rotor pylon, which is chrome-molybdenum steel tubing.

LANDING GEAR.—Quadricycle type.

POWER PLANT.—One 245 n.p. Franklin 6V6-245-B16F six-cylinder vertically-mounted fan-cooled engine. Fuel capacity 62 U.S. gallons (235 litres).

ACCOMMODATION.—Enclosed cabin seating two side-by-side forward and one or two passengers aft. Passenger seats easily removable for cargo operations, and for rescue service two stretchers can be carried inside cabin fore and aft in place of left side seats. Cabin dimensions: length 7 ft. 7 in. (2.32 m.), width 4 ft. 6 in. (1.37 m.), depth 3 ft. 10 in. (1.17 m.). Total cabin capacity 120 cub. ft. (2.39 m.³). Approx. cargo capacity 90 cub. ft. (2.54 m.³)

DIMENSIONS.—
Main rotor diam. 33 ft. (10 m.).
Tail rotor diam. 5 ft. 4 in. (1.62 m.).
Fuselage length 27 ft. 6 in. (8.35 m.).
Height overall 8 ft. 8 in. (2.64 m.).

WEIGHTS.
Weight empty 1,815 lb. (824 kg.).
Normal disposable load 885 lb. (402 kg.)..
Normal loaded weight 2,700 lb. (1,226 kg).

PERFORMANCE (at 2,700 lb.=1,226 kg. A.U.W.).—
Max. speed at S.L. 111 m.p.h. (178 km.h.).
Cruising speed (65% power) at 1,000 ft. (3,050 m.) 91 m.p.h. (146 km.h.).
Max. rate of climb at S.L. 1,050 ft./min. (336 m./min.).
Hovering ceiling with ground effect 4,600 ft. (1,400 m.).
Hovering ceiling without ground effect 2,600 ft. (792 m.).
Service ceiling 12,000 ft. (3,660 m.).
Cruising range 306 miles (492 km.).



The Sikorsky YH-18 Utility Helicopter (245 h.p. Franklin engine)

THE SIKORSKY S-55

U.S.A.F. and U.S. Army designation: H-19.
U.S. Navy and Coast Guard designation: HO4S.
U.S. Marine Corps designation: HRS.

The S-55 is a twelve-seat utility helicopter suitable for passenger, air mail or cargo transport and for air rescue and military service. The novelty of the design is the location of the power-unit in the nose of the fuselage and so mounted that the drive shaft slopes up to base of the rotor pylon, clear of the main cabin situated below the main lifting rotor.



The Sikorsky S-55 Eight-passenger Commercial Helicopter (600 h.p. Pratt & Whitney R-1340 Wasp engine).

The prototype S-55 first flew on November 7, 1949.

Apart from being adopted by the U.S.A.F., U.S. Army Field Forces, U.S. Navy, U.S. Marine Corps and U.S. Coast Guard, the S-55 is also being built under licence in the United Kingdom by Westland Aircraft Ltd. and in France by the S.N.C.A.S.E.

The civil S-55 is fitted with the 550 h.p. Pratt & Whitney Wasp R-1340-S1H2 engine. The many U.S. naval and military versions, which do not all have the same power-plant, are enumerated below :—

H-19A. 550 h.p. Pratt & Whitney R-1340-57 engine. For U.S.A.F. Rotor diameter 49 ft. (14.94 m.). A.U.W. 6,800 lb. (3,087 kg.). Crew of two, plus eight troops or six stretchers.

H-19B. 700 h.p. Wright R-1300-3 engine. For U.S.A.F. Rotor diameter 53 ft. (16.16 m.). A.U.W. 7,300 lb. (3,314 kg.). Crew of two, plus ten troops or eight stretchers.

H-19C. Same as H-19A for U.S. Army Field Forces.

H-19D. Same as H-19B for U.S. Army Field Forces.

HO4S-1 and -2. 550 h.p. Pratt & Whitney R-1340 engine. Similar to H-19A. For U.S. Navy for anti-submarine duties.

HO4S-2G. For U.S. Coast Guard. HO4S-2 fitted for rescue duties.

HO4S-3. 700 h.p. Wright R-1300 engine. Similar to H-19B. For U.S. Navy for anti-submarine duties.

HRS-1 and -2. 550 h.p. Pratt & Whitney R-1340 engine. Similar to H-19A. For U.S. Marine Corps for assault transport duties. Crew of two and eight fully-armed troops.

HRS-3. 700 h.p. Wright R-1300 engine. Similar to H-19B. U.S. Marine Corps assault transport.

HRS-4. 1,025 h.p. Wright R-1820 engine. U.S. Marine Corps assault transport. Crew of two and ten fully-armed troops.

The description and specification which follow refer to the S-55 and may also apply generally to those military versions fitted with the 550 h.p. Pratt & Whitney R-1340 engine. The performance of later military models powered by the Wright R-1300 and R-1820 engines are appreciably higher but details are classified.

TYPE.—Twelve-seat Utility Helicopter.

ROTORS.—Three-blade main rotor and two-blade anti-torque tail rotor. All-metal structures. Rotor mechanism operates as in S-52.

FUSELAGE.—Except for the chrome-molybdenum steel-tube rotor pylon, structure is of aluminium and magnesium semi-monocoque construction.

LANDING GEAR.—Quadricycle type. All-metal amphibious landing-gear is available.

POWER PLANT.—One Pratt & Whitney R-1340 S1H2 Wasp radial air-cooled engine rated at 550 h.p. at 8,000 ft. (2,440 m.) and with 600 h.p. available for take-off at 6,200 ft. (1,890 m.). Engine on angular mounting in nose of fuselage with sloping shaft drive to rotor gear box below head. Large clam-shell doors in nose of fuselage allow complete accessibility to engine from ground level. Internal fuel capacity 190 U.S. gallons (720 litres).

ACCOMMODATION.—Pilot's compartment above main cabin seats two side-by-side with dual controls. Cabin located below main lifting rotor may seat from eight to ten passengers, the ten passengers being seated three against front and rear walls and two on each side, all facing inwards. Up to eight stretchers may be carried six of which can be loaded by power-operated hoist while aircraft is hovering. Pilot's compartment may be entered from the outside or from the cabin so that co-pilot may act as attendant. Cabin dimensions : length 10 ft. (3.05 m.), width 5 ft. 6 in. (1.68 m.), depth 6 ft. (1.82 m.). Total capacity 340 cub. ft. (9.6 m.^{3}).



The Sikorsky HO4S-1 Naval General Utility Helicopter (600 h.p. Pratt & Whitney R-1340 engine). (*Harold Martin*).

DIMENSIONS.—
Main rotor diameter 53 ft. (16.16 m.).
Tail rotor diameter 8 ft. 8 in. (2.64 m.).
Fuselage length 42 ft. 2 in. (12.85 m.).
Height overall 13 ft. 4 in. (4.07 m.).
WEIGHTS.—
Weight empty 4,785 lb. (2,173 kg.).
Max. disposable load 2,050 lb. (932 kg.).
Max. weight loaded 6,835 lb. (3,102 kg.).
PERFORMANCE (at normal A.U.W. of 6,835 lb. = 3,102 kg.—Pratt & Whitney R-1340 engine).—
Max. speed at S/L. 105 m.p.h. (169 km.h.).
Cruising speed (70% power) at 1,000 ft. (305 m.) 90 m.p.h. (145 km.h.).
Max. rate of climb at S/L. 855 ft./min. (261 m./min.).
Vertical rate of climb at S/L. 170 ft./min. (52 m./min.).
Hovering ceiling with ground effect 7,900 ft. (2,410 m.).
Hovering ceiling without ground effect 4,400 ft. (1,340 m.).
Service ceiling 12,900 ft. (3,940 m.).
Range (with reserve) 440 miles (707 km.).

THE SIKORSKY S-56.

U.S. Marine Corps designation: XHR2S-1.

This new Sikorsky Assault transport helicopter is under development for the U.S. Navy Bureau of Aeronautics. It will be powered by two Pratt & Whitney R-2800 engines and will carry up to 34 passengers. All other information on it is classified.

THE SIKORSKY S-57

The designation S-57 has been given to a convertiplane which is the subject of an experimental contract placed under a joint U.S. Air Force/Army convertiplane development programme. No details of this project are available for publication.

THE SIKORSKY S-58.

U.S. Navy designation: HSS-1.
U.S. Army designation: H-34.
U.S. Marine Corps designation: HUS-1.

The S-58 is an enlarged development of the S-55 and will be able to accommodate up to 20 passengers. or 1½ tons of cargo. It will be powered by a 1,640 h.p. Wright R-1820 engine, driving a four-blade rotor. No further details available.

TAYLORCRAFT

TAYLORCRAFT, INC.

HEAD OFFICE AND WORKS: CONWAY-PITTSBURGH AIRPORT, CONWAY, PA.

President: B. J. Mauro.

Vice-Presidents: C. G. Taylor and A. B. Bennett.

Chief Engineer: J. Gilberti.

Production Manager: C. Hodgekin.

Secretary and Treasurer: S. L. Card.

Taylorcraft, Inc. is the successor to the Taylorcraft Aviation Corporation which went bankrupt in 1946. It was reformed by Mr. C. G. Taylor, founder of the original Taylor Aircraft Company and designer of the original Cub light cabin monoplane, who acquired the assets of the defunct Taylorcraft concern at a public auction.

THE TAYLORCRAFT TOURIST.

TYPE.—Four-seat light cabin monoplane.
WINGS. High-wing braced monoplane two-spar structure with spruce spars, pressed aluminium ribs and fabric covering. All-metal flaps and ailerons. Fixed leading-edge slots. Gross wing area 186 sq. ft. (17.28 m.²).
FUSELAGE.—Fabric-covered welded steel-tube structure.
TAIL UNIT.—Braced monoplane type. Welded steel-tube frames, fabric covered.
LANDING GEAR.—Fixed tail-wheel type. Oleo-pneumatic shock-absorbers. Hydraulic wheel-brakes. Steerable tail-wheel.
POWER PLANT.—One 145 h.p. Continental C145-2 six-cylinder horizontally-opposed air-cooled engine. Fuel capacity 40 U.S. gallons (151 litres).
ACCOMMODATION.—Enclosed cabin seating four in two pairs, the front pair with dual controls. Sedan type front and rear cabin doors. Baggage compartment aft of cabin.
DIMENSIONS.—
Span 36 ft. (10.98 m.).
Length 24 ft. (7.32 m.).
Height 7 ft. 1 in. (2.14 m.).
WEIGHTS.—
Weight loaded 2,200 lb. (1,000 kg.).
PERFORMANCE.—
Max. speed 125 m.p.h. (200 km.h.).
Cruising speed 115 m.p.h. (184 km.h.).
Landing speed with flaps 36 m.p.h. (57.6 km.h.).



The Taylorcraft Tourist (145 h.p. Continental C145 engine).

Initial rate of climb 700 ft./min. (213.5 m./min.).
Service ceiling 16,000 ft. (4,880 m.).
Absolute ceiling 17,500 ft. (5,340 m.).
Cruising range 500 miles (800 km.).
Take-off run 500 ft. (154 m.).

THE TAYLORCRAFT MODEL 19 SPORTSMAN.

TYPE.—Two-seat light cabin monoplane.
WINGS.—High-wing braced monoplane. NACA 23012 wing section. Aspect ratio 6.96. Dihedral 1°. Chord 6 ft. 3 in. (1.90 m.). Structure consists of two spruce spars, stamped aluminium ribs and fabric covering. Streamline steel-tube vee bracing struts. Total aileron area 10.15 sq. ft. (0.94 m.²). Gross wing area 186 sq. ft. (17.28 m.²).
FUSELAGE.—Fabric-covered welded steel-tube structure.
TAIL UNIT.—Braced monoplane type. Welded steel-tube frames, fabric covered. Areas: tailplane 13 sq. ft. (1.20 m².), elevators (total) 10.66 sq. ft. (0.99 m².) fin 5.6 sq. ft. (0.52 m.²), rudder 5.76 sq. ft. (0.53 m.²).
LANDING GEAR.—Fixed tail-whee type. Rubber cord springing. Steerable tail-wheel. Brakes on main wheels.
POWER PLANT.—One 85 h.p. Continental C85-12F six-cylinder horizontally-opposed air-cooled engine in pressure cowling. Sensenich two-blade wooden airscrew. Fuel capacity 24 U.S. gallons (91 litres).
ACCOMMODATION.—Enclosed cabin seating two side-by-side. One-piece moulded sun-proof windshield. Door on each side of cabin. Baggage space 2 ft. 6 in. (0.76 m.) square aft of seats. Cabin heating.
DIMENSIONS.
Span 36 ft. (10.98 m.).
Length 22 ft. 4 in. (6.81 m.)
Height 6 ft 6 in. (1.98 m.).
WEIGHTS.—
Weight empty 860 lb. (390 kg.).
Weight loaded 1,500 lb. (680 kg.).
PERFORMANCE.—
Max. speed 120 m.p.h. (192 km.h.).
Cruising speed 110 m.p.h. (176 km.h.).
Landing speed 38 m.p.h. (61 km.h.).
Initial rate of climb 700 ft./min. (213.5 m./min.).
Service ceiling 17,000 ft. (5,185 m.).
Absolute ceiling 24,310 ft. (7,415 m.).
Cruising range 300 miles (480 km.).
Take-off run 300 ft. (91.5 m.).
Landing run 350 ft. (107 m.).

THE TAYLORCRAFT SPECIAL DE LUXE.

The Special De luxe is a lower-powered low-cost version of the Sportsman with certain extra equipment, including metal airscrew, radio, generator, battery and lighting, hand starter, etc. It is powered by a 65 h.p. Continental engine.

DIMENSIONS.—
Same as Sportsman.
WEIGHT LOADED.—1,200 lb. (545 kg.).
PERFORMANCE.—
Max. speed 105 m.p.h. (168 km.h.).
Cruising speed 95 m.p.h. (152 km.h.).
Initial rate of climb 600 ft./min. (183 m./min.).
Service ceiling 15,000 ft. (4,575 m.).
Cruising range 350 miles (560 km.).
Take-off run 350 ft. (107 m.).
Landing run 350 ft. (107 m.).

TEMCO

TEMCO AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: P.O. BOX 6191, DALLAS 2, TEXAS.

OVERHAUL AND MODIFICATION DIVISION: GREENVILLE, TEXAS.

President and General Manager: Robert McCulloch.

Executive Vice-President and Treasurer: H. L. Howard.

Vice-President, Comptroller: Clyde Williams.

Vice-President, Manufacturing: J. A. Maxwell, Jr.

Secretary: Latham Leeds.

The major activities of the Temco Aircraft Corporation are devoted to the manufacture of complete aircraft and major sub-assemblies. Temco holds two prime contracts from the U.S. Navy to build the McDonnell F3H Demon carrier-based jet fighter, and sub-contracts for manufacture of sub-assemblies for the



The Temco TE-1 Buckaroo (165 h.p. Franklin engine).

Boeing B-47, the Lockheed P2V, the Douglas A2D and the Martin P5M.

At a separate overhaul and modification division at Greenville, Texas, the company is reconditioning C-54's for the U.S. Air Force, is developing a prototype C-97 ambulance modification for the U.S. Air Force, and is converting Navions into Riley Twin-Navions under a contract with Riley Aviation.

A limited number of Temco T-35A Buckaroo light military trainers, with armament, have been ordered through the U.S. Air Force for the M.D.A.P. Rocket-firing tests with the T-35A were completed successfully in February, 1953.

In 1953 the former Luscombe subsidiary was merged into the Temco Aircraft Corporation.

THE TEMCO TE-1 BUCKAROO.

U.S. Air Force designation: T-35A.

The TE-1 was developed to meet the need for economy both in first cost and in service, at the same time incorporating all the high-performance characteristics specified for the modern military basic trainer.

TYPE.—Two-seat Light Military Trainer.

WINGS.—Low-wing cantilever monoplane. Wing section NACA 23015 (root) and 23009 (tip). All-metal structure with 24ST Alclad stressed-skin. Gross wing area 134 sq. ft. (12.44 m.²). Aileron area (each) 9.6 sq. ft. (0.89 m.²). Flap area 12.52 sq. ft. (1.16 m.²).

FUSELAGE.—All-metal semi-monocoque structure with lap-jointed 24ST Alclad skin.

TAIL UNIT.—Cantilever monoplane type. Aluminium-alloy structure. Dihedral tailplane. Controllable trim-tabs in rudder and elevators. Tailplane area 13.16 sq. ft. (1.22 m.²). Fin area 4.41 sq. ft. (0.41 m.²). Elevator area 8 sq. ft. (0.74 m.²). Rudder area 6 sq. ft. (0.56 m.²).

LANDING GEAR.—Retractable tail-wheel type. Temco air-oil shock-absorbers. Goodyear wheels and brakes. Full swivelling and steerable tail-wheel. Track 9 ft. 8½ in. (2.97 m.).

POWER PLANT.—One 165 h.p. Franklin 6A4 - 165 - B3 six-cylinder horizontally-opposed air-cooled engine driving a Koppers Model F-200-H two-blade controllable-pitch airscrew. Fuel capacity 32.5 U.S. gallons (122.8 litres). Oil capacity 2 U.S. gallons (7.5 litres).

ACCOMMODATION.—Tandem seats with complete dual control. Continuous transparent canopy with sliding sections over each seat. Seats are adjustable and removable. Full electrical equipment. Radio, landing lights, lights, etc.

ARMAMENT.—Two 30-cal. wing-mounted machine-guns and racks for ten 2.75 in. rockets, five under each wing.

DIMENSIONS.—
Span 29 ft. 4 in. (8.94 m.).
Length 21 ft. 8 in. (6.6 m.).
Height 6 ft. 1½ in. (1.87 m.).

WEIGHTS AND LOADINGS.—
Weight empty 1,300 lb. (591 kg.).
Crew (two) and parachutes 380 lb. (172 kg.).
Fuel and oil 189 lb. (86 kg.).
Baggage, etc. 51 lb. (24 kg.).
Weight loaded 1,920 lb. (873 kg.).
Wing loading 14.3 lb./sq. ft. (69.8 kg./m.²).
Power loading 13.2 lb./h.p. (5.9 kg./h.p.).

PERFORMANCE (at 1,975 lb. = 896 kg. A.U.W.).—
Max. speed at S/L. 156 m.p.h. (250 km.h.).
Initial rate of climb 1,000 ft./min. (305 m./min.).
Climb to 3,000 ft. (915 m.) 3.2 min.
Climb to 6,000 ft. (1,830 m.) 7.5 min.
Climb to 12,000 ft. (3,660 m.) 21.7 min.
Service ceiling 17,000 ft. (5,185 m.).
Take-off distance to clear 50 ft. (15.25 m.) 875 ft. (267 m.).
Landing distance from 50 ft. (15.25 m.) 740 ft. (226 m.).

TEXAS A. & M. COLLEGE

PERSONAL AIRCRAFT RESEARCH CENTER, AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS.

ADDRESS: COLLEGE STATION, TEXAS. Director: Fred E. Weick.

A programme of research on agricultural aviation problems is being undertaken at the Personal Aircraft Research Center of the A. and M. College of Texas. This programme, which was initiated by the National Flying Farmers Association, in co-operation with the Civil Aeronautics Administration, the Department of Agriculture and the A. and M. College of Texas, includes the development of aircraft specifically designed for dusting, spraying, seeding and fertilising, and improved dispersing equipment.

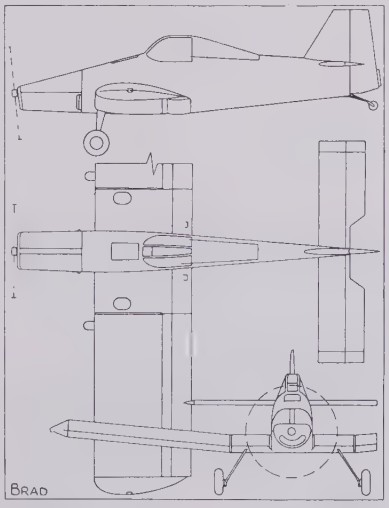
An aircraft has been designed and built under a C.A.A. contract which became effective on December 7, 1949, and this aircraft, the Ag-1, made its first flight on December 1, 1950. This project was aided by personnel assigned for various periods by the C.A.A., the Department of Agriculture, two aircraft manufacturers and the Texas A. and M. College, and many important parts and components, including the engine, airscrew, landing-gear, seat, etc., were contributed by their manufacturers.

The Ag-1 was designed by Mr. Fred Weick to incorporate the characteristics most desired in dusting and spraying aircraft, information on which was obtained from operators partly by personal interview but mostly from a C.A.A. survey which covered the entire country. It is now being used in an investigation on dispersing equipment for spray and dust.

THE Ag-1.

TYPE.—Single-seat Experimental Agricultural monoplane.

WINGS.—Low-wing cantilever monoplane. Modified NACA 64021 wing section. Thickness ratio 21%. Dihedral (outer wings) 5°. Incidence 2°. All-metal construction. Full-span slotted flaps and slot-lip ailerons. Detachable wing-tips.



The Texas A. & M. College Ag-1.



The Texas A. and M. College Ag-1 Agricultural Monoplane.

FUSELAGE.—Rectangular metal structure with domed after deck.

TAIL UNIT.—Cantilever monoplane type. All-metal structure. Detachable tips. Span of tail 17 ft. 9 in. (5.41 m.).

LANDING GEAR.—Tail-wheel type. Cessna-type spring steel struts for main wheels and spring for tail-wheel. Goodyear main wheels, low-pressure tyres and brakes. Scott steerable and full-swivelling tail-wheel. Main landing-gear legs are sharpened so as to cut any wires or cables encountered in flight. Track 12 ft. (3.66 m.)

POWER PLANT.—One 225 h.p. Continental E225 six-cylinder horizontally-opposed air-cooled engine driving a McCauley two-blade one-piece aluminium-alloy airscrew 7 ft. 6 in. (2.28 m.) in diameter. Later an Aeromatic variable-pitch airscrew will be fitted. Fuel tank in fuselage behind engine bulkhead. Fuel capacity 48 U.S. gallons (181 litres).

ACCOMMODATION.—Open cockpit over trailing-edge of wing. Decking forward of cockpit slopes 15°. Headrest forms a turnover structure and guide tubes from windscreen to headrest and cable from headrest to top of fin provided for protection against cables or wires contacted in flight.

EQUIPMENT.—Hopper for dust, seed or fertiliser in fuselage in front of cockpit with, initially, an adjustable sliding gate and distributor beneath fuselage. Capacity of hopper 27 cub. ft. (7.64 m.³). Two synthetic rubber-lined tanks for spray liquid in centre-section, one on each side of fuselage. Total capacity 150 U.S. gallons. Engine-driven pump delivers liquid through manifolds to outlet nozzles. Initially, the spray boom is located within wing contour from tip to tip. There is room in outer wings for installation of additional experimental dust hoppers.

DIMENSIONS:—
Span 39 ft. (11.89 m.).
Length 29 ft. 8 in. (9.05 m.).
Height 8 ft. 7 in. (2.61 m.).

WEIGHTS.—
Weight empty 1,900 lb. (863 kg.).
Weight loaded 3,400 lb. (1,543 kg.).

PERFORMANCE (Estimated with full load).—
Max. speed 115 m.p.h. (184 km.h.).
Cruising speed 100 m.p.h. (160 km.h.).
Operating speeds 60-90 m.p.h. (96-144 km.h.).
Landing speed (normal) 45 m.p.h. (72 km.h.).
Landing speed (without payload) 37 m.p.h. (59 km.h.).
Rate of climb 600 ft./min. (183 m./min.).
Service ceiling 12,000 ft. (3,660 m.).
Cruising range 400 miles (640 km.).
Cruising endurance 3½ hours.
Take-off to 50 ft. (15.25 m.) 1,300 ft. (396 m.).

YUGOSLAVIA

IKARUS

MAIN FACTORY: ZEMUN.

The Yugoslav aircraft industry consists essentially of a central national research, design and prototype manufacturing and testing establishment, and a number of purely production factories. The principal establishment perpetuates the name "Ikarus" which was borne by the first aircraft manufacturing company to be formed in Yugoslavia in 1923.

Before the war the Yugoslav aircraft industry was made up of three main firms. Ikarus A.D. with factories at Novi Sad and Zemun; Prva Srpska Fabrika Aeroplana Zivojin Rogojarsky with a factory at Belgrade; and Fabrika Aeroplana i Hidroplana "Zmaj" with a factory at Zemun. All these factories, in addition to building aircraft of various types under licence, including the Potez 25, Hawker Fury, Bristol Blenheim, Dewoitine D.27, Gourdou-Leseurre B.3 and Hanriot training aircraft, produced a variety of types of original design, most of which were illustrated and described in the inter-war editions of "All the World's Aircraft."

During the German occupation all these factories were destroyed and it was not until 1945 that the Ikarus plant at Zemun was sufficiently rebuilt and re-equipped to be able to resume aircraft work. As a nationalised plant it began with the repair and overhaul of YaK-3, YaK-9 and IL-2 Stormovik aircraft belonging to the Sovietised Yugoslav Air Force.

In August, 1946, the remnants of the former Rogojarsky and "Zmaj" companies and their surviving technical staffs were incorporated in the national Ikarus concern and the design and manufacture of aircraft was resumed.

The first post-war aeroplane of original design was the Aero-2 designed by Engineers Cijan and Petkovik, a two-seat trainer, the prototype of which first flew in October, 1946. This aircraft, which was produced in quantity for the Yugoslav Air Force, was developed through various versions with differing power-plants.

At about the same time the C-3, designed by Cijan and Petrovic, won a competition for a light trainer suitable for use by national flying clubs and schools and was also put into production.

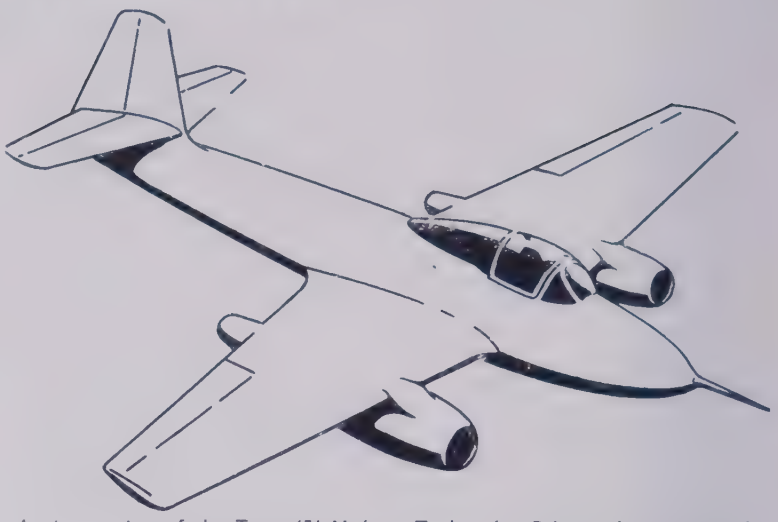
Before the break with the Cominform the only military aircraft built in Yugoslavia were of Russian design. The Ilyushin IL-2 was built by Ikarus, and trainer versions of the IL-2 and YaK-3 were also developed and built.

Since the break, however, Yugoslavia has undertaken the design and construction of its own military aircraft. The first example was the S-49, a redesign of the YaK-9 by Sivčev, Zrnic and Popovic. This aircraft has been developed through the S-49A fitted with the Russian VK-105 copy of the Hispano-Suiza 12Y engine, to the S-49C which is powered by the French-built Hispano-Suiza 12Z of greater power.

Two other types produced in 1951 were the Type 214 designed by Eng. Prof. Milutinovic and the Type 215, designed by Eng. Stankov, both twin-engined aircraft intended for training and general purpose duties. The former was selected for production for the Air Force as an aircrew trainer.

A 1949 prototype, the Type 213 two-seat advanced trainer, has recently been modified and fitted with a 600 h.p. Pratt & Whitney Wasp engine, and as the Type 522 has been put into production.

Two of the most recent prototypes built by Ikarus are the Type 451-M, designed by Major Beslin, and the Type 452, designed by Major Beslin and Engineers Levacic and Kostic.



An impression of the Type 451-M (two Turboméca Palas turbojet engines), the first jet-powered aircraft of Yugoslav design.

THE TYPE 451-M.

The 451-M is a jet-powered conversion of the conventional 451 light twin-engined trainer, originally powered by two 160 h.p. Walter Minor 6-III engines. The conversion consisted of replacing the piston engines by two Turboméca Palas turbojets to evolve the first jet-powered aircraft of national design. No other details are available.

THE TYPE 452.

The 452 is a single-seat research aircraft with swept wings and tail surfaces and is powered by two Turboméca Palas turbojets mounted one above the other at the rear of the fuselage. The vertical tail surfaces are mounted at the ends of twin booms, with the Vee tailplane in between the fins and supported at its centre by a dorsal fin on the aft end of the fuselage. Separate air inlets are provided for the two engines; in the wing roots for the lower engine and on the side of the rear fuselage for the upper engine. The landing-gear is a retractable tricycle. No other details are available but the general arrangement of the Type 452 can be gathered from the accompanying sketches.

THE TYPE 522.

TYPE.—Two-seat Advanced Trainer developed from the Type 213.

DESIGNERS. Engineers Sostaric and Dabinovic.

WINGS.—Low-wing cantilever monoplane. All-metal construction.

FUSELAGE. Oval section all-metal structure.

TAIL UNIT. Cantilever monoplane type.

LANDING GEAR. Tail-wheel type. Main wheels retract forward into fairings at the wing roots. Non-retracting tail-wheel.

POWER PLANT.—One 600 h.p. Pratt & Whitney R-1340 Wasp nine-cylinder radial air-cooled engine.

ACCOMMODATION.—Tandem seats under a continuous canopy with sliding sections over each cockpit.

DIMENSIONS, WEIGHTS AND PERFORMANCES.—No data available.

THE S-49C.

TYPE.—Single-seat Fighter.

DESIGNERS.—Engineers Sivcev, Zrnic, and Popovic.

WINGS.—Low-wing cantilever monoplane. Two-spar all-metal structure.

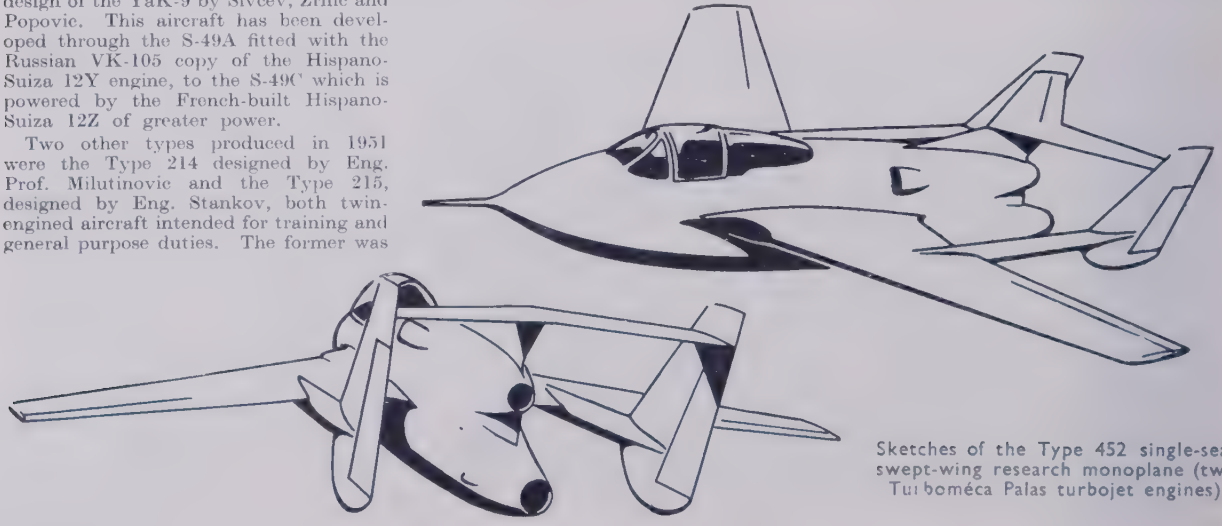
FUSELAGE.—Welded steel tube structure.

TAIL UNIT.—Cantilever monoplane type.

LANDING GEAR.—Retractable tail-wheel type. Main wheels retract inwardly into wings, tail-wheel backward into fuselage.

POWER PLANT.—One 1,500 h.p. Hispano-Suiza 12Z twelve-cylinder vee liquid-cooled engine driving a three-blade airscrew. Radiator under fuselage aft of wings.

ACCOMMODATION.—Enclosed cockpit with sliding canopy. Bullet-proof windscreen and armour plate protection.



Sketches of the Type 452 single-seat swept-wing research monoplane (two Turboméca Palas turbojet engines).

ARMAMENT.—Two 12.7 mm. machine-guns in top cowling and one 20 mm. cannon firing through the airscrew hub.
DIMENSIONS AND WEIGHTS.—
No data available.
PERFORMANCE.—
Max. speed 640 km.h. (400 m.p.h.) at 1,525 m. (5,000 ft.).

THE TYPE 214 MONOPLANE.

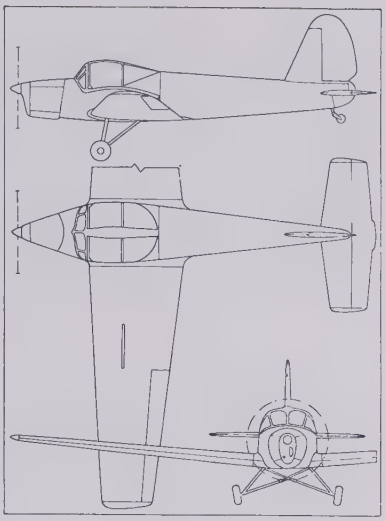
TYPE.—Twin-engined Bombing and Aircrew Trainer.
DESIGNER.—Eng. Prof. Sima Milutinovic
WINGS.—Low-wing cantilever monoplane. Dihedral outboard of engine nacelles.
FUSELAGE.—Oval section structure.
TAIL UNIT.—Braced monoplane type with twin fins and rudders.
LANDING GEAR.—Retractable type. Main wheels retract backwards into engine nacelles, leaving part of wheels projecting. Fixed tail-wheel.
POWER PLANT.—600 h.p. Pratt & Whitney R-1340 nine-cylinder radial air-cooled engines.
ACCOMMODATION.—Enclosed cockpit seating two side-by-side over leading-edge of wings. Bomb-aimer's position in nose with observation windows and optically flat aiming panel. Cabin aft of pilot's compartment for navigator, radio-operator or 6-8 pupils.
DIMENSIONS, WEIGHTS AND PERFORMANCE.—No data available.

THE TYPE 215 MONOPLANE.

TYPE.—Twin-engined Communications and Training monoplane.
DESIGNER.—Eng. Dusan Stankov.
WINGS.—Low-wing cantilever monoplane. Dihedral from roots. Flaps fitted.
FUSELAGE.—Oval section structure with solid nose.
TAIL UNIT.—Braced monoplane type with twin fins and rudders.
LANDING GEAR.—Retractable type. Main wheels retract backwards into engine nacelles. Fixed tail-wheel.
POWER PLANT.—Two 480 h.p. Ranger SGV-770 twelve-cylinder inverted vee air-cooled engines driving two-blade airscrews.
ACCOMMODATION.—Enclosed cockpit seating two side-by-side with dual controls. Observer facing aft in cabin under transparent fairing.
DIMENSIONS, WEIGHTS AND PERFORMANCE.—No data available.

THE C-3 TROJKA (THREE).

TYPE.—Two-seat Light monoplane.
DESIGNERS.—Engineers Boris Cijan and Petrovic.
WINGS.—Low-wing cantilever monoplane. Single-spar all-wood structure. Detachable wing-tips. Spoiler-type slatted air-brakes on top surfaces hinge downward into slots aft of main spar when not in use. Wing area 15.5 m.² (166.8 sq. ft.).
FUSELAGE.—All-wood structure in two main portions with joint aft of cabin. Rear fuselage a pure monocoque.
TAIL UNIT.—Cantilever monoplane type. All-wood structure. Single-piece tailplane and elevator. Detachable fin and horn-balanced rudder. Trim-tab in centre of elevator.
LANDING GEAR.—Split type. Two hinged side vees and two half axles with rubber cord springing at inner ends of axles. Swivelling tail-wheel.
POWER PLANT.—One 60 h.p. Walter Mikron II four-cylinder in-line inverted air-cooled

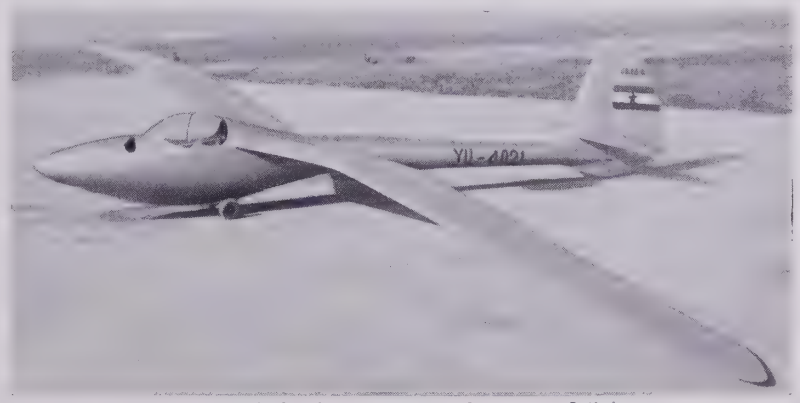


The Cijan C3 Trojka.

engine on steel-tube mounting. Two-blade fixed-pitch airscrew. Fuel tank aft of seats. Oil tank in engine compartment.
ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Cabin top is divided on fore-and-aft centre-line and each curved side section slides aft for access to both seats.
DIMENSIONS.—
Span 10.5 m. (34 ft. 5 in.).
Length 8.85 m. (29 ft.).
Height 2.10 m. (6 ft. 10 in.).
WEIGHTS AND LOADINGS.—
Weight empty 374.7 kg. (824.3 lb.).
Weight loaded 603.7 kg. (1,328.1 lb.).
Wing loading 39.0 kg./m.² (7.99 lb./sq. ft.).
PERFORMANCE.—
Max. speed 161 km.h. (100 m.p.h.).
Cruising speed 145 km.h. (90 m.p.h.).
Min. speed 73.6 km.h. (45.7 m.p.h.).
Landing speed (with air-brakes) 65 km.h. (40.4 m.p.h.).
Climb to 1,000 m. (3,280 ft.) 10.3 min.
Service ceiling 3,900 m. (12,790 ft.).
Range 590 km. (376 miles).
Take-off run 177 m. (174 yds.).
Landing run (with air-brakes) 215 m. (211 yds.).

THE ORAO II (EAGLE II).

TYPE. Single-seat High-performance Sailplane.
DESIGNERS.—Engineers Boris Cijan and Obad.
WINGS.—Mid-wing cantilever monoplane. Single main spar of aluminium alloy in inner part of wing and of wood in outer part. Wing forward of spar covered with diagonal plywood skin and aft of spar with fabric. Slotted flaps interconnected with plain ailerons to serve as high-lift device. Frise type ailerons on outer wings. Dive brakes. Gross wing area 17.79 m.² (191.4 sq. ft.).
FUSELAGE.—Forward portion is of oval section with wood longerons, frames and plywood covering. Rear portion is a wooden sandwich monocoque with balsa filling between stringers and covered on both sides with diagonal plywood.
TAIL UNIT.—Cantilever monoplane type. Wood fin integral with fuselage. Tailplane, rudder and elevators are single-spar structures, the tailplane covered with plywood and the elevators and rudder with fabric. Statically-balanced elevators have controllable trim-tabs.
LANDING GEAR.—Main skid, sprung by rubber blocks, is attached to fuselage by leather strap. Tail skid springing provided by tennis balls.
ACCOMMODATION.—Enclosed cockpit with removable canopy. Cabin ventilation. All flight and blind-flying instruments. Oxygen equipment. Provision for back-type parachute. Compartment for barograph and oxygen bottles.
DIMENSIONS.—
Span 19.0 m. (62 ft. 4 in.).
Length 7.745 m. (25 ft. 5 in.).
Height 1.0 m. (3 ft. 3 in.).
WEIGHTS AND LOADINGS.—
Weight empty 314 kg. (691 lb.).
Disposable load 110 kg. (242 lb.).
Weight loaded 424 kg. (933 lb.).
Wing loading 23.84 kg./m.² (116.34 lb./sq. ft.).
PERFORMANCE.—
Gliding ratio 1 : 31.4.
Min. sinking speed 0.593 m./sec. at 67.2 km.h. (1.9 ft./sec. at 41.7 m.p.h.).
Sinking speed at 110 km.h. (68.3 m.p.h.) 1.43 m./sec. (4.6 ft./sec.).
Stalling speed (without flaps) 63.4 km.h. (39.2 m.p.h.).
Max. permissible diving speed with dive brakes extended 220 km.h. (136.6 m.p.h.).



The Orao II Single-seat high-performance Sailplane.

LETALSKI KONSTRUKCIJSKI BIRO LZS.

ADDRESS: LEPI POT 6, LJUBLJANA.
Secretary: Marjan Slanovec.

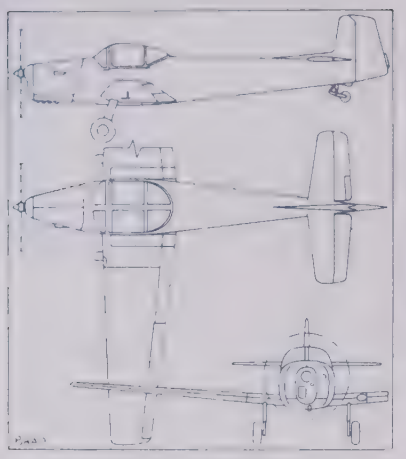
The Letalski Konstrukcijski Biro (Aircraft Design office) was formed in 1947. It is working on an amateur basis and consists of students from the High Technical School in Ljubljana. It supplies new designs to the Yugoslav Aeronautical Union.

Earlier designs of this office include the Triglav I, II and III high-performance sailplanes and the Jadran amphibian sailplane, all designed by Koser and Hrovat, and the Udarnik high performance sailplane designed by Cener and Slanovec. All these sailplanes are in use by national aero clubs.

The latest designs are the KB-6 Matajur two-seat light training and touring monoplane designed by D. Cener, and the KB-9 high-performance sailplane designed by M. Slanovec. The KB-6 is going into series production, while the KB-9 is being used to investigate the most suitable structure for a laminar-flow wing.

THE KB-6 MATAJUR.

TYPE.—Two-seat Trainer and Tourer.
WINGS.—Low-wing cantilever monoplane. Aspect ratio 8. Taper ratio 0.5. Dihedral 5° 30′. Wood structure with one main spar. Plywood covering over leading-edge, fabric over remainder. Auxiliary spar carries flaps and statically and aerodynamically balanced ailerons. Flap area 1.42 m.² (15.3 sq. ft.). Total aileron area 1.38 m.² (14.8 sq. ft.). Gross wing area 14.0 m.² (150.7 sq. ft.).
FUSELAGE. — All-wood semi-monocoque structure.
TAIL UNIT.—Cantilever monoplane type. Fixed surfaces are all wood, aerodynamically balanced elevators and rudder have wood frames and fabric covering. Starboard elevator has trim-tab controllable from cockpit.
LANDING GEAR.—Fixed tail-wheel type. Spring-oil shock-absorbers. Steerable tail-wheel. Hydraulic wheel brakes. Track 2.5 m. (8 ft. 2 in.).
POWER PLANT.—One 136 h.p. Régnier 4L00 four-cylinder in-line inverted air-cooled engine on steel-tube bearers. Two-blade fixed-pitch wood airscrew, 1.95 m. (6 ft. 5 in.) diameter. Aluminium fuel tank



The KB-6 Matajur.

(141 litres = 37.2 Imp. gallons) in fuselage behind seats. Oil tank 9 litres (2.4 Imp. gallons).

ACCOMMODATION.—Enclosed cabin seating two side-by-side with dual controls. Adjustable seats. Baggage compartment aft of seats. Full electrical equipment. Glider towing hook. Touring version has upholstered cabin.

DIMENSIONS.—
Span 10.6 m. (34 ft. 9 in.).
Length 8.36 m. (27 ft. 5 in.).
Height 2.15 m. (7 ft. 1 in.).

WEIGHTS AND LOADINGS.—
Weight empty 659 kg. (1,453 lb.).
Crew (2) with parachutes 180 kg. (397 lb.).
Fuel and oil 110 kg. (234 lb.).
Baggage 30 kg. (66 lb.).
Weight loaded 979 kg. (2,159 lb.).
Wing loading 70 kg./m.² (14.3 lb./sq. ft.).
Power loading 7.8 kg./h.p. (15.6 lb./h.p.).

PERFORMANCE.—
Max. speed at S/L. 222 km.h. (138 m.p.h.).
Cruising speed 200 km.h. (124 m.p.h.).
Stalling speed with flaps 88 km.h. (55 m.p.h.).
Initial rate of climb 210 m./min. (689 ft./min.).
Service ceiling 4,500 m. (14,800 ft.).
Range 820 km. (510 miles).





Two views of the KB-6 Matajur (136 h.p. Régnier 4L00 engine).

THE KB-9 EKSPERIMENTAL.

TYPE.—Single-seat High-performance Sailplane.

WINGS.—Shoulder-wing cantilever monoplane. NACA 643-618 laminar-flow wing section. Aspect ratio 16. All-wood structure with plywood skin specially designed for aerofoil smoothness and accuracy. Gross wing area 16 m.² (172.2 sq. ft.).

FUSELAGE.—Oval section semi-monocoque structure with plywood skin.

TAIL UNIT.—Cantilever monoplane type. Plywood-covered fixed surfaces, fabric-covered rudder and elevators. Controllable trim-tab in starboard elevator.

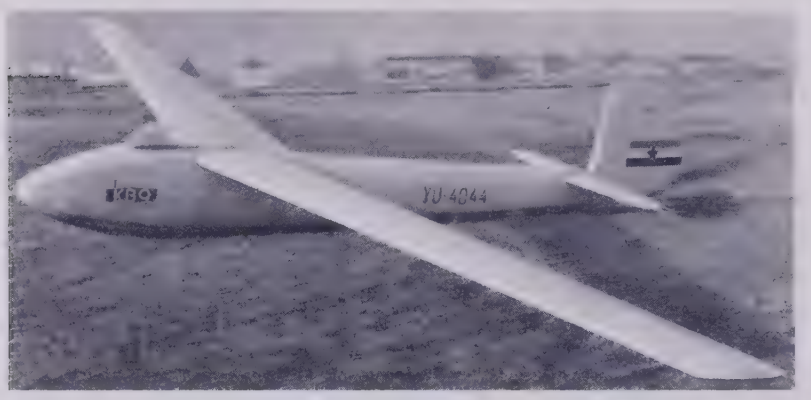
LANDING GEAR.—Wood central skid.

ACCOMMODATION.—Pilot's cockpit with "bubble" canopy.

DIMENSIONS.—
Span 16 m. (52 ft. 6 in.).
Length 7.6 m. (24 ft. 11 in.).
Height 1.73 m. (5 ft. 8 in.).

WEIGHTS AND LOADINGS.—
Weight empty 274 kg. (605 lb.).
Pilot 90 kg. (198 lb.).
Weight loaded 364 kg. (803 lb.).
Wing loading 22.75 kg./m.² (4.65 lb./sq. ft.).

PERFORMANCE.—
Best gliding ratio 1 : 32.6 at 83 km.h. (51.6 m.p.h.).
Min sinking speed 0.71 m./sec. (2.33 ft./sec.) at 79 km.h. (49.3 m.p.h.).
Sinking speed at 100 km.h. (62 m.p.h.) 0.94 m./sec. (3.08 ft./sec.).
Sinking speed at 140 km.h. (86 m.p.h.) 1.82 m./sec. (5.97 ft./sec.).
Max. permissible speed 250 km.h. (156 m.p.h.).



The KB-9 Single-seat High-performance Sailplane.

ALL THE WORLD'S AERO-ENGINES

(CORRECTED TO AUGUST 31st, 1953)

ARRANGED IN TWO PARTS:

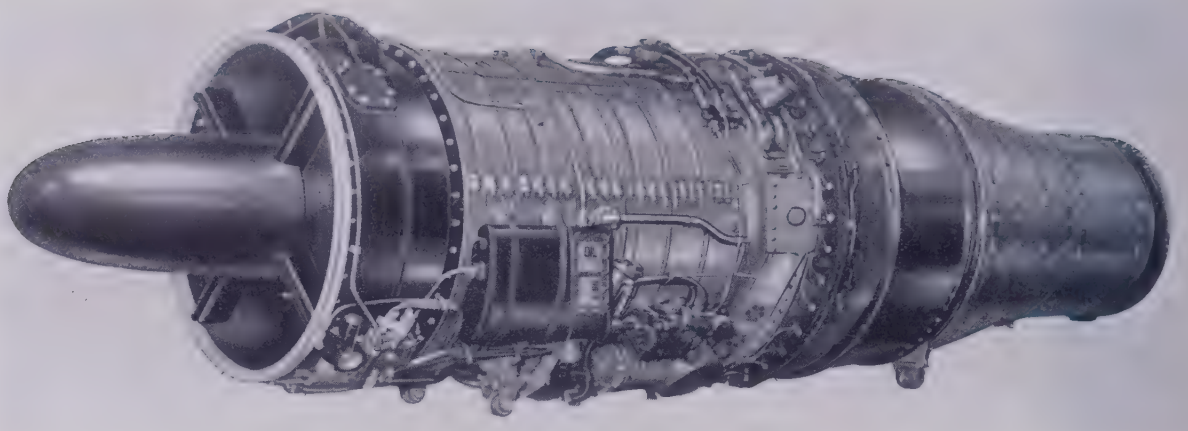
(1) GAS-TURBINE ENGINES
(2) PISTON ENGINES

PART I—GAS TURBINE ENGINES

THE BRITISH COMMONWEALTH

GREAT BRITAIN

ARMSTRONG SIDDELEY



The Armstrong Siddeley Sapphire axial-flow turbojet which has a static thrust rating of 8,300 lb. (3,770 kg.).

ARMSTRONG SIDDELEY MOTORS LTD.
HEAD OFFICE AND WORKS : COVENTRY.

Directors : Sir Frank Spencer Spriggs, K.B.E., Hon. F.R.Ae.S. (Chairman), Sir Thomas Sopwith, C.B.E., Hon. F.R.Ae.S., H. Burroughes, F.R.Ae.S., H. T. Chapman, C.B.E., F.R.Ae.S., M.I.Mech.E. (Managing Director), W. F. Saxton, M.B.E. (General Manager), M. N. Golovine, M.B.E., D.L., A.F.R.Ae.S. (Aero Sales).

Prior to their entry into the gas turbine field Armstrong Siddeley Motors had done some of the early experimental work on axial-flow compressors and blade forms, as well as manufacturing the R.A.E. research contra-flow unit in 1939 to the designs of Dr. Griffiths.

Early in 1942 the design of the A.S.X. engine was prepared. This was a jet engine of high efficiency to give a sea level static thrust of 2,500 lb. (1,134 kg.) with a specific consumption of less than unity. The prototype unit was produced in 1943, having taken only nine months for design and manufacture.

During the development of the A.S.X. engine, design studies were made of alternative means for increasing the thrust with a view to applying the turbine engine to moderate speed aircraft and the decision was taken to develop a turboprop engine based on the A.S.X. This resulted in the Python airscrew-turbine engine which first ran and passed its acceptance test in 1945. The Python engine powers the Westland Wyvern S. Mk. 4 Strike aircraft which was going into service with the Royal Navy in 1953.

In 1945 it was decided to design a turboprop engine in the 1,000 h.p. class, and in April, 1946, the prototype engine, named the Mamba, ran for the first time. The Mamba passed its Type-Test in February, 1948.

The latest Armstrong Siddeley engine is the Sapphire which is in super-priority production for several of the latest aircraft ordered by the Royal Air Force.

Other important engines are the Double Mamba, which powers the Fairey Gannet, and the Viper, which was evolved as a "short-life" engine but is now being developed as a conventional long-life engine and in its latter form will be fitted to the jet version of the Percival Provost trainer.

In 1950 an agreement was concluded between Armstrong Siddeley Motors, Ltd. and the Curtiss-Wright Corporation whereby Curtiss-Wright acquires the right to build Armstrong Siddeley gas-turbine engines in the United States.

In 1953 a licence for the manufacture in France of the Viper long-life turbojet engine was acquired by Avions Marcel Dassault.

THE ARMSTRONG SIDDELEY SAPPHIRE.

The Sapphire engine, developed from the original design by Metropolitan Vickers, Limited of Manchester, is a turbojet with an axial-flow compressor and an annular combustion chamber of the Armstrong Siddeley vaporising type.

The ASSa.3 completed a 150-hour Service Type Test in November, 1951, at a sea level static maximum rating of 7,500 lb. (3,450 kg.) with a specific consumption of 0.91 lb./hr./lb. (kg./hr./kg.). In May, 1952, a later mark of Sapphire, the ASSa.6, passed the 150-hour Type Test at 8,300 lb. (3,770 kg.) s.t., as a result of which the engine was cleared for production at 8,000 lb. (3,632 kg.) thrust. The Sapphire powers the Gloster Javelin, the Hawker Hunter F. Mk. 2 and the Handley Page Victor.

Mention may also be made of two further versions, the ASSa.4 and the ASSa.7, but no details were available for publication at the time of writing.

The Sapphire is in large-scale production in the United States, under the designation J65, by the Wright Aeronautical Corporation and the Buick Division of General Motors Corporation. The J65 powers the Republic F-84F, the Martin B-57A Canberra, the North American FJ-3 and has been chosen for other as yet unspecified aircraft.

DIMENSIONS.
- Length overall from point of nose fairing to exhaust cone rear flange 133.85 in. (3.400 m.).
- Diameter over bare engine 37.4 in. (0.950 m.).
- Diameter over trunnion mounting 37.3 in. (0.974 m.).
- Max. width over accessories 43.0 in. (1.092 m.).
- Frontal area (bare engine) 7.4 sq. ft. (0.68 $m.^2$).

WEIGHT (Dry).—
2,600 lb. (1,180 kg.) ± 2½%.

PERFORMANCE RATING.—
Sea level static thrust 8,300 lb. (3,770 kg.).

THE ARMSTRONG SIDDELEY PYTHON 3.

TYPE.—Axial-flow Turboprop with 14-stage compressor, 11 combustion chambers and 2-stage turbine.

PROPELLER DRIVE.—Epicyclic spur reduction gear driven from front end of compressor, drives two contra-rotating co-axial propeller shafts. Standard gear ratio 0.135 : 1. SBAC Nos. 5½ and 7½ shafts. Torquemeter and propeller brake. Rotol eight-blade contra-rotating constant-speed feathering propeller.

AIR INTAKE.—Annular intake surrounds engine amidships. Air enters through eleven radially disposed ducts between rear ends of combustion chambers into rear end of compressor.

COMPRESSOR.—Reverse-flow type with five low and nine high-pressure stages. Two forged aluminium-alloy drum type rotors joined between the 5th and 6th stages form the 14 stage axial flow compressor. Cast aluminium-alloy stator casing, split horizontally, has one row of inlet guide vanes and 13 rows of stator blades. All blades are of aluminium-alloy. Compression ratio 5.35 : 1. Mass air flow 52.5 lb. (23.8 kg.) per sec. at 8,000 r.p.m. at sea level.

COMBUSTION CHAMBERS.—Eleven tubular stainless steel combustion chambers each containing a concentrically-mounted flame tube of Nimonic 75 alloy. Armstrong Siddeley pre-vapourising system of combustion in which fuel from main jet is vapourised and partly mixed with air in mixing chamber before it enters the combustion space proper. Final mixing of combustion gases by deflectors just aft of flame tube exit.

FUEL SYSTEM.—Distributor and 11 main leads to Armstrong Siddeley burner-vapouriser fed by Lucas variable-stroke multi-plunger pump with relief valve and overspeed governor. Armstrong Siddeley flow-control unit. Single-lever control with fuel and propeller controls interconnected.

FUEL GRADE.—Standard Aviation Turbofuel.

NOZZLE GUIDE VANES.—Turbine outer casing of stainless steel incorporating two rows of nozzle guide vanes of Nimonic 80 alloy, 82 blades in first row and 92 in second.

TURBINE.—Two-stage turbine. Twin air-cooled disc of Hadfield HGT3 alloy carries two stages of blading, each stage consisting of 120 blades of Nimonic 80 alloy. Fir tree blade roots. Disc is on hollow shaft which runs on air cooled ball and roller bearings.

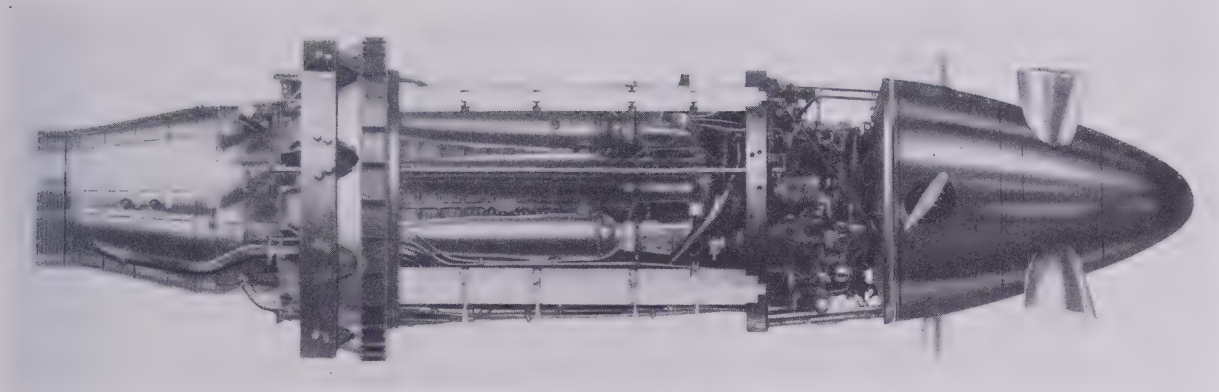
JET PIPE.—Fixed inner cone and stainless steel sheet outer casing.

ACCESSORY DRIVES.—Located round reduction gear casing behind propeller spinner. Additional 100 h.p. take-off at 0.336 engine speed for Rotol or similar accessory gearbox.

LUBRICATION SYSTEM.—Main bearings pressure fed, turbine bearings fed by Tecalemit micropump, rest of lubrication by Armstrong Siddeley pumps. Main supply pressure 70 lb./sq. in. (4.9 kg./$km.^2$).

OIL SPECIFICATION.—D.Eng.R.D.2472.

MOUNTING.—Eleven brackets located at rear



The Armstrong Siddeley Python turboprop engine which has a take-off output of 3,670 s.h.p. plus 1,180 lb. (535 kg.) jet thrust.

of intake casing. Pipes, controls, and cables brought to bulkhead adjacent to mounting brackets.

STARTING.—B.T.H. QT.20 turbo, or Armstrong Siddeley air or cartridge-operated vane starter. Two Armstrong Siddeley igniter plugs energised by two B.T.H. high-tension coils.

CONTROL SYSTEM.—Single-lever pilot's control interconnected with airscrew and fuel controls.

DIMENSIONS.—
Overall diameter 54.5 in. (1.384 mm.).
Length 122.7 in. (5.570 mm.).
Frontal area 16.2 sq. ft. (1.50 m.²).

WEIGHT.—
3,450 lb. (1,565 kg.) + 2½%.

PERFORMANCE RATINGS.—
Take-off (static) 3,670 shaft h.p. plus 1,180 lb. (535 kg.) jet thrust (4,110 equivalent s.h.p.) at 8,000 r.p.m. at sea level.
Max. continuous (static) 2,900 shaft h.p. plus 1,050 lb. (476 kg.) jet thrust (3,303 equivalent s.h.p.) at 7,800 r.p.m. at sea level.

CONSUMPTIONS.—
Fuel (cruising at 7,800 r.p.m. at 350 m.p.h. = 560 km.h. at 20,000 ft. = 6,100 m.) 0.80 lb. (0.36 kg.) per e.s.h.p./hr.
Oil 3.0 lb. (1.36 kg.) per hour.

THE ARMSTRONG SIDDELEY MAMBA Mk. 504.

The Mamba turboprop engine exists in several forms. The description below refers generally to the ASMa.3. Other versions include the ASMa.5 which develops an output of 1,450 s.h.p., and the ASMa.6, for which no figures were available at the time of writing.

TYPE.—Axial-flow Turboprop with ten-stage compressor and two-stage turbine.

PROPELLER DRIVE.—Shaft driven through compound epicyclic helical and spur reduction gearing incorporating a torquemeter. Standard gear ratio 0.97 : 1. Shaft supported by one ball thrust bearing and a bronze bush at the rear end. Shaft size S.B.A.C. No. 4. Rotol or de Havilland four-blade constant-speed fully-feathering and braking propeller may be fitted.

COMPRESSOR.—Annular intake surrounding reduction-gear. Two-piece forged aluminium-alloy casing, split horizontally, with one row of entry guide vanes, ten rows of light-alloy stator blades and one row of outlet straightener blades dovetailed into circumferential slots. Ten rotor stages each consisting of a row of light alloy blades riveted between rims of a pair of steel discs shrunk on to an aluminium-alloy drum. First three and last two stages are steel blades, the rest are aluminium. Front and rear shafts supported in two-row ball and single-row roller bearings respectively. Reduction gear driven by sun-gear mounted on front shaft. Drives for engine and aircraft accessories taken off reduction gearing. Spherical coupling connects rear shaft through hollow extension shaft to turbine rotor. Compression ratio 5.35 : 1. Mass air flow at 15,000 r.p.m. at sea level 17.6 lb. (8.0 kg.) per sec.

COMBUSTION CHAMBERS.—Six interconnected straight-through flow vaporising-type chambers with stainless steel outer casings and Nimonic alloy flame tubes. Each flame tube has four fuel metering jets at front end feeding into four J-shaped primary air tubes which vaporise fuel and lead mixture upstream into air flow.

FUEL SYSTEM.—One Lucas A variable-stroke multi-plunger with relief valve and overspeed governor. Lucas CCU combined fuel flow control unit, filter and isolator. Armstrong Siddeley slotted-piston fuel distributor with six main fuel outlets. Armstrong Siddeley burner-vaporisers.

FUEL.—Standard Aviation Turbofuel.

TURBINE.—Two-stage turbine. Cast stainless steel manifold with 72 first-row and 95 second-row nozzle blades of Nimonic 80 alloy. Twin rotor discs of Jessop G.18B alloy, joined by Hirth coupling, air-cooled. Discs mounted on hollow stub shaft by clamping bolt. Rotor bearing of single roller type, air-cooled.

TAIL PIPE.—Fixed area type. Steel casing and fixed inner cone.

LUBRICATION.—Main bearing pressure-fed. Turbine bearing fed by Tecalemit PE.7710 micropump, Armstrong Siddeley pumps for the rest of the oil system, reduction gear and torquemeter. Main oil supply at 70 lb./sq. in. (5 kg./cm.²). Gauze filter.

OIL.—D.Eng.R.D.2479 plus additive.

STARTING.—24-volt Rotax EXP.4112 electric starter, or Armstrong Siddeley air/cartridge-operated vane starter or B.T.H. QT.19 cordite turbo starter. Two Armstrong Siddeley torch igniters, four Kigass atomisers and two B.T.H. C2TS or C7TS high-tension coils.

DIMENSIONS.—
Diameter 29 in. (737 mm.).
Length 80 in. (2,032 mm.).
Frontal area 4.6 sq. ft. (0.43 m.²).

NET DRY WEIGHT.
800 lb. (362 kg. + 2½%).

RATINGS.—
Take-off (static) 1,320 shaft h.p. plus 405 lb. (184 kg.) jet thrust (1,475 equivalent s.h.p.) at 15,000 r.p.m. at sea level.
Max. continuous (static) 1,050 shaft h.p. plus 355 lb. (161 kg.) jet thrust (1,185 equivalent s.h.p.) at 14,500 r.p.m. at sea level.

CONSUMPTIONS.—
Fuel (cruising at 14,500 r.p.m. at 350 m.p.h. = 560 km.h. at 20,000 ft. = 6,100 m.) 0.67 lb. (0.304 kg.) per e.s.h.p./hr.
Oil (cruise) 2 lb. (0.9 kg.) per hr.

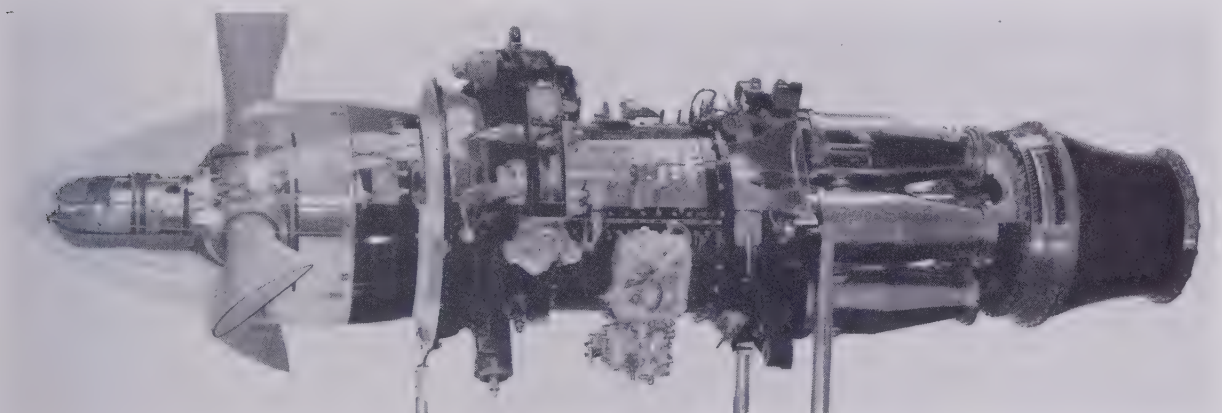
THE ARMSTRONG SIDDELEY DOUBLE MAMBA Mk. 100.

The Double Mamba consists basically of two Mamba engines placed side-by-side and driving two contra-rotating co-axial airscrews. Although the two engines are joined together at the front end and use the same air intake and airscrew-shaft gear casing, they are otherwise two quite separate power-units. Each has its own fuel, lubrication and control systems, its own reduction-gear, and each drives one of the two co-axial airscrews. Each engine can be stopped, started, cruised or feathered under conditions entirely separate from the other. The Double Mamba is capable of running on Aviation turbofuel, "wide-cut" turbine fuel, Admiralty Diesel Oil (47 Cetane No.), or any mixture of these three fuels.

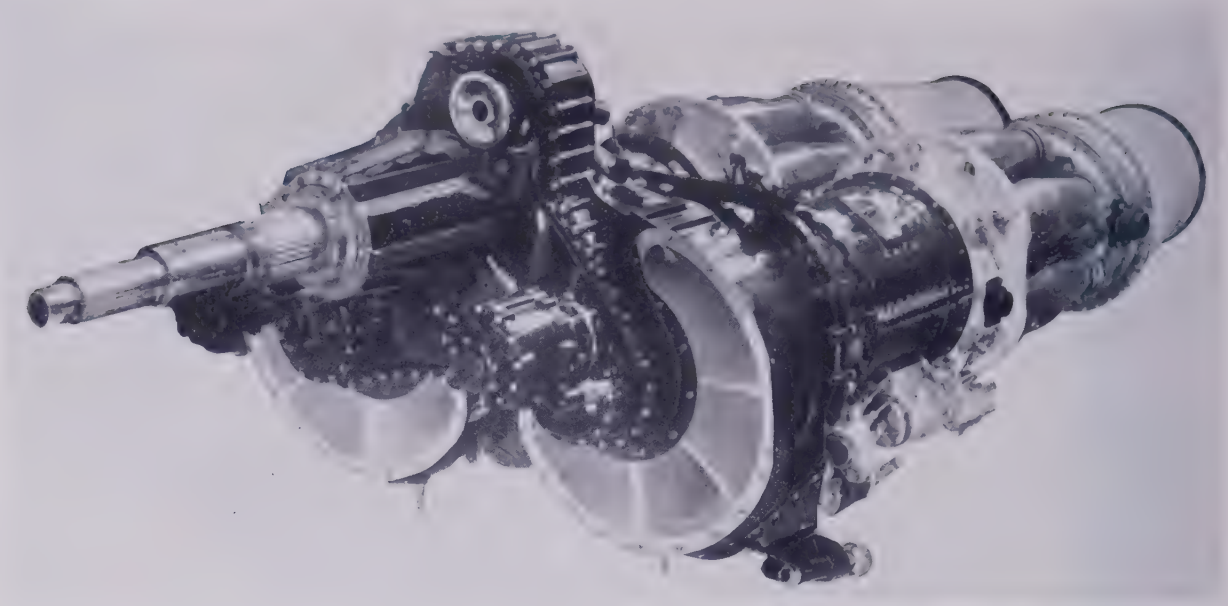
The Double Mamba powers the Fairey Gannet Anti-Submarine monoplane.

The two engines are standard Mambas and the description which follows is only concerned with the components which are peculiar to the Double Mamba.

The description below refers to the ASMD.1 (Mk. 100), which is made up of two ASMa.3 units. Two other versions may be mentioned, the ASMD.3 and



The Armstrong Siddeley Mamba turboprop engine which develops 1,320 s.h.p. plus 405 lb. (184 kg.) jet thrust.



The Armstrong Siddeley Double Mamba turboprop engine which has a take-off rating of 2,640 s.h.p. plus 810 lb. (360 kg.) jet thrust.

ASMD.4, which use, respectively, single Mamba ASMa.5 and ASMa.6 units.

TYPE.—Dual Turboprop made up of two Mamba engines, each driving independently one of two co-axial propeller shafts.

COMPRESSORS, COMBUSTION CHAMBERS, TURBINES.—As for Mamba.

FRONT CASING.—Two Mamba engines without their individual reduction gears mounted on front casing which houses helical and spur reduction gears and drives for engine auxiliaries and aircraft accessory gear box. Each airscrew shaft has its separate train of gears and a roller clutch to prevent rotation during flight when either propeller is feathered. A free-wheel arrangement enables either unit to drive the aircraft accessories drive-shaft. Casing consists of three main magnesium castings containing the reduction gearing and air passages from kidney-shaped air entries to an annulus before the compressors. Three mounting points on casing. Either engine unit can be removed without disturbing rest of the assembly.

AIRSCREW DRIVE.—Two co-axial independent airscrew shafts, sizes S.B.A.C. No. 4 (front) and No. 6 (rear). Standard reduction ratio 0.0965 : 1 (10.36 : 1). Torquemeters and propeller brakes are incorporated. Shafts, whose centre-lines are 11 in. (27.9 cm.) above those of the two engine units, supported by ball and roller bearings. Provision for Rotol eight-blade constant-speed feathering and braking airscrew.

FUEL SYSTEM.—Each engine component has its individual system as for Mamba.

ACCESSORY DRIVES.—Gearbox mounted above air intake casing and driven by shaft which is geared to both airscrew shafts, an idler being inserted to obtain correct direction of rotation. Free-wheel assembly provided to avoid connected drive between two components. Drive can transmit up to 100 h.p. at maximum r.p.m. and full power is available when either engine is feathered.

LUBRICATION.—Separate system for each half as for Mamba ASMa.3. Each gear train in reduction gear is lubricated with oil from driving engine.

OIL.—D.Eng.R.D.2479 plus additive.

STARTING.—Two 24-volt Rotax 4112 electric, or two Rotax cordite turbo starters, one for each component, mounted on front of reduction-gear casing. Two ASM torch igniters, four Kigass atomisers and two B.T.H. C2TS or C7TS ignition coils per component.

ENGINE CONTROLS.—Each engine component has its individual system as for Mamba.

DIMENSIONS.—
Width 52.8 in. (1,341 mm.).
Length 102 in. (2,590 mm.).
Height 43.85 in. (1,111 mm.).

WEIGHT.—
2,150 lb. (970 kg.) + 2½%.

RATINGS.—
Take-off (static) 2,640 shaft h.p. plus 810 lb. (368 kg.) jet thrust (2,950 equivalent s.h.p.) at 15,000 r.p.m. at sea level.
Max. continuous (static) 2,100 shaft h.p. plus 710 lb. (277 kg.) jet thrust (2,373 equivalent s.h.p.) at 14,500 r.p.m. at sea level.

CONSUMPTIONS.—
Fuel (cruising at 14,500 r.p.m. at 350 m.p.h. = 560 km.h. at 20,000 ft. = 6,100 m.) 0.67 lb. (0.36 kg.) per e.s.h.p./hr.
Oil (cruise) 4 lb. (1.8 kg.) per hr.

THE ARMSTRONG SIDDELEY ADDER.

The Adder is a pure jet version of the Mamba engine previously described. It powers the Pika piloted target aircraft which has been designed and built in Australia, and the Swedish Saab-210 delta-wing research aircraft.

TYPE.—Gas-turbine with ten-stage axial-flow compressor and two-stage turbine.

COMPRESSOR.—As for Mamba except drives for engine and aircraft accessories taken through gearing at front of engine. Rear shaft connected through spherical coupling to hollow extension shaft to which turbine rotor is attached. Compression ratio 5.35 : 1. Mass air flow at 15,000 r.p.m. at sea level 17.6 lb. (8.0 kg.) per sec.

COMBUSTION CHAMBERS, TURBINE, TAIL PIPE, FUEL SYSTEM.—As for Mamba.

LUBRICATION.—Pressure feed to main bearings Tecalemit PE7710 micropump feed to turbine bearing, Armstrong Siddeley pumps for the rest of the oil system. Main oil supply at 70 lb./sq. in. (5 kg./cm.²). Gauge filter.

STARTING.—Rotax EXP3150 24-volt electric starter mounted in nose fairing. Two ASM torch igniters, four Kigass atomisers and two B.T.H. C2TS or C7TS high-tension coils.

DIMENSIONS.—
Diameter 28 in. (711.2 mm.).
Length 73.3 in. (1,863 mm.).

NET DRY WEIGHT.
580 lb. (263 kg.) + 2½%.

RATINGS.—
Take-off (static) 1,050 lb. (475 kg.) at 15,000 r.p.m. at sea level.
Max. continuous (static) 870 lb. (392 kg.) at 14,250 r.p.m. at sea level.

CONSUMPTIONS.
Fuel (cruising at 14,250 r.p.m. at 350 m.p.h. = 560 km.h. at 20,000 ft. = 6,100 m.) 1.30 lb./lb. thrust/hr. (1.30 kg./kg. thrust/hr.).
Oil (cruise) 1 lb. (0.45 kg.) per hr.

THE ARMSTRONG SIDDELEY VIPER.

The Viper turbojet was originally designed for "short-life" full-throttle operation in expendible aircraft such as the Australian Jindivik pilotless target aircraft, for which the Viper ASV.3 (1,640 lb. = 745 kg. s.t.) is in production.

In order to reduce cost the engine has been simplified as far as practicable and, consistent with its short but active life, only the most economical low grade materials are used in its construction.

The Viper is also being developed as a conventional "long-life" engine suitable for piloted aircraft. The ASV.5 of this type has been chosen to power the jet version of the Percival Provost trainer.

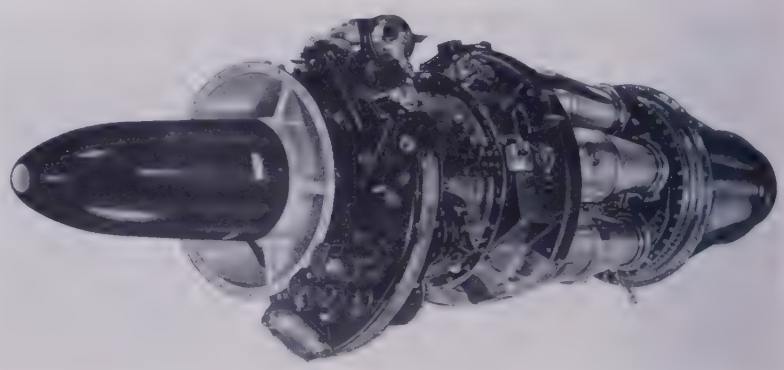
DIMENSIONS.—
Diameter 23.25 in. (59 cm.).
Overall length 82.7 in. (210 cm.).

NET DRY WEIGHT.—
365 lb. (166 kg.).

RATING.—
Take-off static 1,640 lb. (745 kg.).

THE ARMSTRONG SIDDELEY SNARLER.

The Snarler is a liquid fuel rocket motor which is intended primarily to assist the manoeuvrability of fighter aircraft at very high altitudes where the thrust of jet engines has fallen off to such an extent that little or no margin of power



The Armstrong Siddeley Adder turbojet engine.

is available for manoeuvring. It can also be used as a climb assister during the later stages of a climb.

The Snarler motor consists basically of a combustion chamber, pumps which deliver the propellants under pressure to the combustion chamber and tanks for liquid oxygen and methanol/water. In addition, there are certain small safety and control devices which are necessary for the satisfactory operation of the motor.

The motor is controlled by two switches in the pilot's cockpit, a master switch which starts or stops the rocket and a two-position "throttle" switch which selects either part or full thrust.

For a weight of 215 lb. (97.6 kg.) the Snarler produces a thrust of 2,000 lb. (908 kg.). It can run for an indefinite period, the length of time being determined only by the amount of fuel that can be carried.

Work on the Snarler began in the autumn of 1947. A special category flight clearance test was completed in May, 1950, and the motor was flight tested for the first time on November 20, 1950, in a Hawker P.1072. This aircraft is a Nene-powered P.1040 which has been modified to take the Snarler in the extreme tail and the various tanks and other associated equipment amidships.



The Armstrong Siddeley Viper expendable turbojet engine.

BRISTOL

BRISTOL AEROPLANE COMPANY, LTD. (Engine Division).

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Through times of rapid technical change, the Bristol company has adhered to its traditional policy by providing engines of the highest thermal efficiency. With their Theseus engine, the first turboprop engine to pass the Ministry of Supply Type Test, they accumulated much experience ranging from test-bed development to service with R.A.F. Transport Command.

The first Proteus ran in 1947 and was followed two years later by the coupled Proteus. Continuous development produced the Proteus 600 (single) and 610 (coupled) engines in the Princess flying-boat, and the Proteus 625 engines now flying in the first prototype Britannia airliner.

The Proteus engine has now been completely redesigned and reappears as the 700 Series. These engines are notably more powerful than their predecessors, and are at the same time shorter and lighter.

Conservative assumptions were made in the design of the 700 Series engine and its rated performance as originally estimated has been considerably exceeded on test. These ratings, however, remain in force for the 700 Series because the mechanical design of the engine was based upon them. The company has, however, taken advantage of the potential performance of the engine and has now announced the Proteus 750 Series, the first major mechanical development of the 700 Series, and capable of running at the higher ratings already achieved without detriment to the engine's reliability and life between overhauls.

With the expanding operational scope of the jet engine the need for fuel economy has become more and more insistent. The first Bristol turbojet, the Olympus, employs a compounded compressor system which overcomes the restrictions on the choice of pressure ratio. By this means it has been possible to design for and obtain a fuel economy not within the reach of a single-shaft engine.

On May 4, 1953, the Canberra used for flight development of the Olympus engine established a new World's Altitude Record of 63,668 ft. (19,408.7 m.).

THE BRISTOL OLYMPUS.

The Olympus is the first British turbojet engine of the "compound" or "two-spool" type.

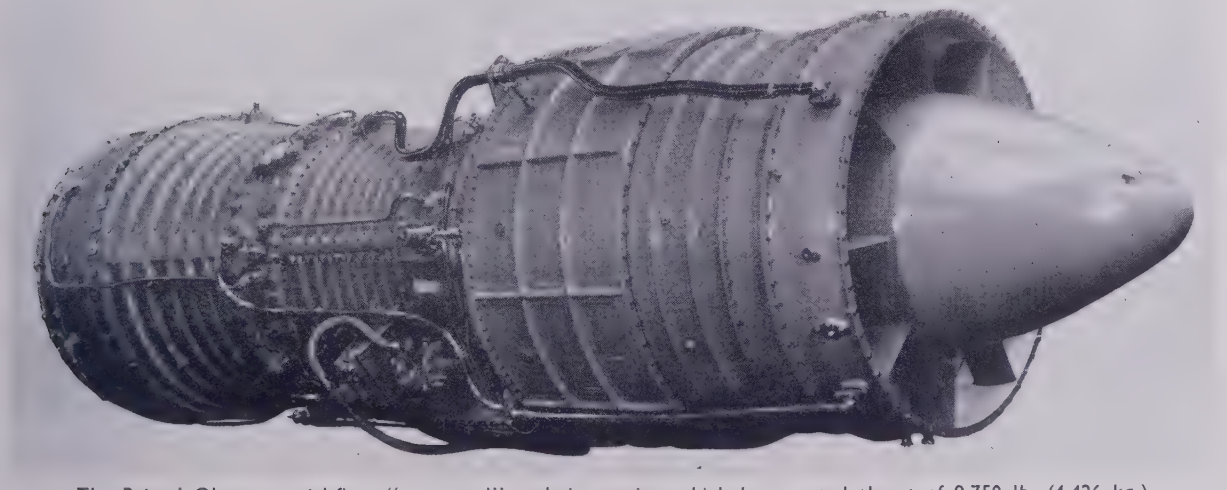
The engine consists basically of a low-pressure system and a high pressure system. The high pressure system has a compressor, combustion section and turbine, and may therefore be thought of as a complete gas turbine engine. On an entirely separate shaft, the low pressure system has a compressor fed from the atmosphere and delivering to the H.P. compressor. The low pressure compressor is driven by a low pressure turbine which receives gas from the H.P. turbine and discharges to the jet pipe. By strict analogy the L.P. section therefore acts as an exhaust-driven supercharger for the H.P. section. Since the overall compression ratio is obtained by multiplying together the individual pressure ratios of the L.P. and H.P. systems, these ratios are themselves quite low. The effect of this is to confer the ease of starting and handling associated with a simple low-pressure-ratio engine, with the fuel economy which can only be obtained by high pressure ratio.

The Olympus has been chosen to power the Avro Vulcan four-engined delta bomber, and it is also being manufactured under licence by the Wright Aeronautical Corporation of America. The U.S. military designation of the Olympus is J67.

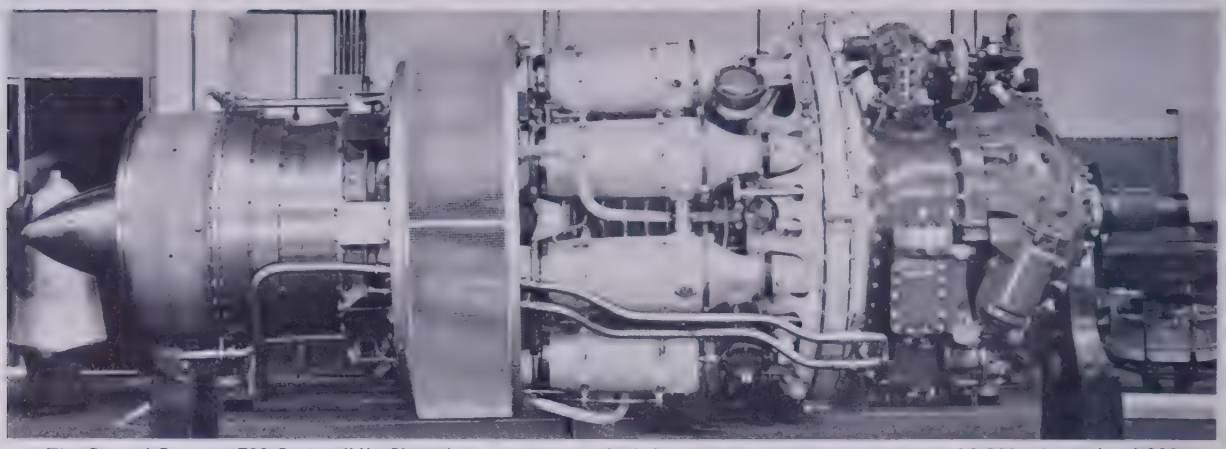
Development of this engine is proceeding, but no information beyond the following may be published:—

DIMENSIONS.—
Diameter 40 in. (101.6 cm.).
Length (intake flange to exhaust flange) 124 in. (315 cm.).

WEIGHT.—
3,250 lb. (1,475.5 kg.).



The Bristol Olympus axial-flow "two-spool" turbojet engine which has a rated thrust of 9,750 lb. (4,426 kg.).



The Bristol Proteus 700 Series (Mk. 3) turboprop engine which has a maximum power output of 3,320 s.h.p. plus 1,200 lb. (545 kg.) jet thrust.

PERFORMANCE.
Max. thrust 9,750 lb. (4,426 kg.).

FUEL CONSUMPTION.
0.766 lb./lb. thrust/hr. (0.766 kg. kg. thrust/hr.).

THE BRISTOL PROTEUS 750 SERIES.

This is the first development derivative of the recently introduced 700 Series, from which it differs mechanically by having a new reduction gear designed to take the high output which the Series 700 engine has proved itself able to deliver.

The engine gives 10% more power than the 700 for the same specific fuel consumption and a weight increase of less than 2%. The external dimensions of the engine are unchanged.

DIMENSIONS.—
Overall diameter 39.5 in. (100 cm.).
Length, cone fitting line to jet pipe 100.5 in. (255.3 cm.).

NETT DRY WEIGHT (including accessory gearbox drive assembly but less exhaust duct and bullet).—
2,850 lb. (1,292 kg.).

PERFORMANCE RATINGS (Preliminary data).—
Take-off (static) 3,650 s.h.p. plus 1,320 lb. (600 kg.) jet thrust at max. compressor r.p.m. at sea level.
Max. continuous power (static) 3,210 s.h.p. plus 1,210 lb. (550 kg.) jet thrust at 97.5% max. compressor r.p.m. at sea level.

CONSUMPTIONS. -
Fuel, at max. power (5 min. limit) 0.71 lb. (.322 kg.) per s.h.p./hr.
Fuel, at max. continuous power 0.495 lb. (.224 kg.) per e.h.p./hr. at 345 m.p.h. (552 km.h.) and 35,000 ft. (10,675 m.).

THE BRISTOL PROTEUS 700 SERIES.

The first production version of the Proteus is designated 700 Series. This series, of which the Mk. 705 will power the production Bristol Britannia Mk. 100 airliner, has already proved itself capable of exceeding the brochure performance quoted hereunder. The engine is a completely new design in detail, and the latest advances in aerodynamic technique have been brought to bear, particularly in the design of the compressor and turbines. In general layout the engine follows the earlier 600 Series except that a second stage has been added to the compressor turbine, while the centrifugal stage is now located immediately following the axial section, without any intermediate duct or separate bearing for the impellor.

Mechanically, again, the redesign is complete, although care has been taken to preserve in essence the sound features developed during the many thousands of hours of running experience with the 600 Series engines.

The air intake, still between the compressor and turbine sections, is now a single light alloy casting which, besides being a full structural member of the engine body, provides an aerodynamically efficient entry and eliminates any contamination or heating of the entering air.

The compressor still has twelve axial stages followed by a single centrifugal stage, but has been reduced in diameter, allowing more room for the combustion system, and in length by reducing the pitch of the stages towards the delivery end, as well as by the re-location of the centrifugal impellor.

In the interests of rugged dependability in service, all the blading is now in stainless steel.

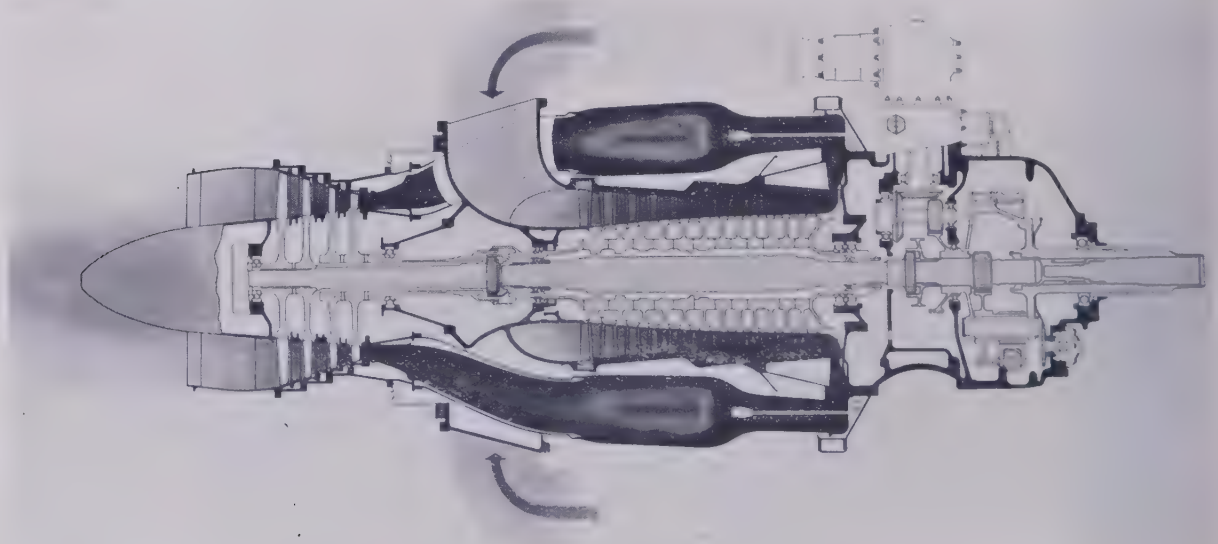
The eight combustion chambers remain of the conventional downstream injection type, but have been redesigned on more generous lines, with skin-cooled flame tubes.

The two-stage compressor turbine is of smaller diameter and its performance has been improved, particularly by the introduction of tip shrouds on the rotor blades which minimise the losses at this point. The 600 Series engines had an unshrouded single stage power turbine, but this has been replaced on the 700 Series engines by a two-stage turbine, of which the first has shrouds. Following previous Bristol practice, the drives from the two turbines are entirely independent.

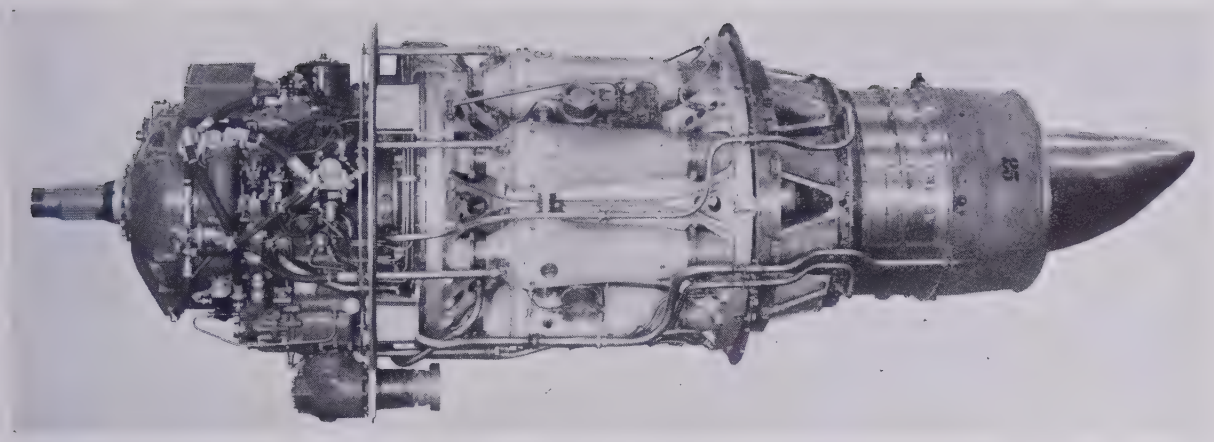
The compound epicyclic reduction gear follows previous design practice and incorporates a hydraulic torquemeter operated by the reaction on the stationary member of the epicyclic train, and a parking brake to prevent the propellers of a parked aircraft from being windmilled.

Mounting has been simplified and the engine is now carried at four points in the plane of the centrifugal impellor.

The following description and specification refers to the Proteus 705, four of



The flow diagram of the Bristol Proteus 700 Series turboprop engine.



The Bristol Proteus 600 Series (Mk. 2) turboprop engine which has a maximum power rating of 3,200 s.h.p. plus 800 lb. (363 kg.) jet thrust.

which power the Britannia Mk. 100 airliner.

TYPE.—Turboprop engine with twelve axial and one centrifugal stages of compression and two separate two-stage turbines, one driving the compressor and one the propeller.

PROPELLER DRIVE.—Compound epicyclic reduction gear with drive from free turbine. Ratios 11.111 or .909 : 1.

AIR INTAKE.—Radial type between compressor and turbine sections. The intake is a single light alloy casting and is a full structural member of the engine body. Inlet air flow 43 lb. (19.5 kg.) per sec. Provisions for de-icing.

COMPRESSOR.—Twelve axial stages followed by a single centrifugal stage. Axial rotor made up of twelve discs bolted to shaft. Rotor blades (714) secured in axial grooves of "fir-tree" section. Stator blades (644) held in circumferential grooves of "dovetail" section in light alloy two-piece casing. Single steel centrifugal impeller has 31 vanes and is flanged and bolted to shaft. Radial diffuser of high-temperature aluminium-alloy directs air to eight transfer ducts leading to combustion chambers. Compression ratio 7.2 : 1. Mass air flow 43 lb. (19.5 kg.) per sec.

COMBUSTION CHAMBERS.—Eight tubular chambers of mild steel with concentrically mounted flame tubes of Nimonic alloy. Lucas Simplex burners with downstream injection. K.L.G. igniter plugs in primary zone of two flame tubes. Rotax H.T. booster coil.

FUEL SYSTEM.—Lucas system incorporating fuel pump, throttle valve, barometric pressure control, H.P. shut-off cock and burners. Maximum fuel pressure 1,400 lb./sq. in. (98.4 kg./cm.²). Water injection available for special performance.

FUEL GRADE.—D.E.R.D. 2482.

NOZZLE GUIDE VANES.—Eighty Nimonic alloy blades precision cast in segments of 3 or 7 blades.

TURBINE.—Two separate two-stage axial turbines, first driving the compressor and second the propeller reduction gear through bore of compressor rotor. All blades machined from Nimonic alloy and secured to stainless steel rotor discs by "fir-tree" roots. 80 blades in first stage, 70 in second, 56 in third and 64 in fourth. Gas temperatures 847°C. before turbine, 500°C. after turbine.

JET PIPE.—Fixed. Austenitic stainless steel jet pipe and inner cone.

ACCESSORY DRIVES.—From main reduction gear below engine to auxiliary box, which has drives for all accessories, including generator and cabin blower.

LUBRICATION SYSTEM.—Dry sump. Bristol gear type pump and accessories. Oil tank capacity 14 Imp. gallons, including air space and feathering compartment.

OIL SPECIFICATION.—DTD.2479.

MOUNTING.—Four-point mounting with pads in plane of centrifugal impeller.

STARTING.—Electric starter on gear case. Plessey starting pump.

DIMENSIONS.—
Overall diameter 39.5 in. (100 cm.).
Length (from cone fitting line to jet pipe) 100.5 in. (255.3 cm.).
Frontal area 8.5 sq. ft. (0.78 m.²).

NET DRY WEIGHT.—
2,810 lb. (1,273 kg.).

PERFORMANCE RATINGS.—
Take-off (static) 3,320 s.h.p. plus 1,200 lb. (545 kg.) jet thrust at 12,000 compressor r.p.m. at sea level.
Max. continuous power 2,920 s.h.p. plus 1,100 lb. (500 kg.) jet thrust at 11,700 compressor r.p.m. at sea level.

CONSUMPTIONS.—
Fuel 0.495 lb. (.224 kg.) per e.h.p./hr. at max. continuous power at 345 m.p.h. (552 km.h.) and 35,000 ft. (10,675 m.).
Oil 2 pints (1.13 litres) per hour.

THE BRISTOL PROTEUS 600 SERIES.

Engines of this series, which was fully described in the previous issue, powered the first Bristol Britannia (Mk. 625) during the first stage of its trials and are fitted in the Princess flying-boat (Mk. 600 single and Mk. 610 coupled engines).

The dimensional particulars and flight ratings for these engines are given hereunder, the powers and thrusts for the 610 being twice those quoted for the 600.

DIMENSIONS.
Overall diameter 41.4 in. (105 cm.).
Length (cone fitting line to jet pipe) 113.3 in. (288 cm.).

NET DRY WEIGHT (including accessory gear box drive assembly but less exhaust duct and bullet).—
3,390 lb. (1,540 kg.).

PERFORMANCE (Proteus 600) (flight ratings).—
Max. power output (static) 2,500 s.h.p. plus 830 lb. (376 kg.) jet thrust at max. compressor r.p.m. at sea level.
Max. continuous power 2,000 s.h.p. plus 700 lb. (318 kg.) jet thrust at 96% max. compressor r.p.m. at sea level.

PERFORMANCE (Proteus 625) (flight ratings). —
Max. power output (static) 2,800 s.h.p. plus 910 lb. (413 kg.) jet thrust at max. compressor r.p.m. at sea level.
Max. continuous power 2,240 s.h.p. plus 760 lb. (345 kg.) jet thrust at 96% max. compressor r.p.m. at sea level.

CONSUMPTIONS (Proteus 600).—
Fuel, at max. power (5 min. limit) 0.85 lb. (0.386 kg.) per s.h.p./hr.
Fuel, at max. continuous power 0.63 lb. (0.286 kg.) per s.h.p./hr. at 345 m.p.h. (552 km.h.) and 30,000 ft. (9,150 m.).

CONSUMPTIONS (Proteus 625). —
Fuel, at max. power (5 min. limit) 0.82 lb. (0.372 kg.) s.h.p./hr.
Fuel, at max. continuous power 0.61 lb. (0.277 kg.) at 345 m.p.h. (552 km.h.) and 30,000 ft. (9,150 m.).

DE HAVILLAND

THE DE HAVILLAND ENGINE COMPANY, LTD.

HEAD OFFICE : STONEGROVE, EDGWARE, MIDDLESEX.

Directors : Major F. B. Halford, C.B.E., F.R.Ae.S., M.S.A.E. (Chairman), F. T. Hearle, C.B.E., M.I.P.E., F.R.Ae.S., Sir Geoffrey de Havilland, C.B.E., A.F.C., F.R.Ae.S., R.D.I., W. E. Nixon, F.C.I.S., F. E. N. St. Barbe, A. F. Burke, O.B.E., M.Inst.T., F.R.S.A. (Managing), J. L. P. Brodie, M.I.A.E., M.I.Mech.E. and H. Buckingham.

The de Havilland Engine Co., Ltd. entered the jet-propulsion field in the Spring of 1941. Design of the first D.H. jet engine—the H-1 or Goblin—began in April, 1941, and within a year the prototype was running on the Hatfield test-beds. Within two months the engine was giving its designed thrust, by March 5, 1943, it was flying in a Gloster Meteor, and by September 20, 1943, it was taking the D.H.100 Vampire single-seat single-jet fighter monoplane on its initial flights.

The Goblin powers the D.H. Vampire, for which it was specifically designed.

The Ghost was the first pure jet engine to be selected to power a civil aircraft, the D.H. 106 Comet, and the first to obtain civil A.R.B. type-approval. It is also the power-unit of the D.H. 112 Venom fighter. For the day, night and naval versions of the Venom, as well as for the Comet, the Ghost is being manufactured in large quantities in the United Kingdom and under licence in Sweden, Switzerland and Italy.

Under development is the Gyron, de Havilland's first axial-flow turbojet engine.

The Sprite introduced in 1949, was the first cold rocket motor for semi-permanent installation produced in the United Kingdom. It is available for use in both military or civil transport aircraft.

THE DE HAVILLAND GYRON.

It is permitted to mention the existence of a large de Havilland axial-flow turbojet engine known as the Gyron, but at the time of writing no details were available. It was claimed for the Gyron that, at the time of its announcement, it had a maximum thrust output greater than that of any other known prototype engine.

Although originally developed as a private venture by the de Havilland company, the Gyron is now the subject of a Ministry of Supply development contract.

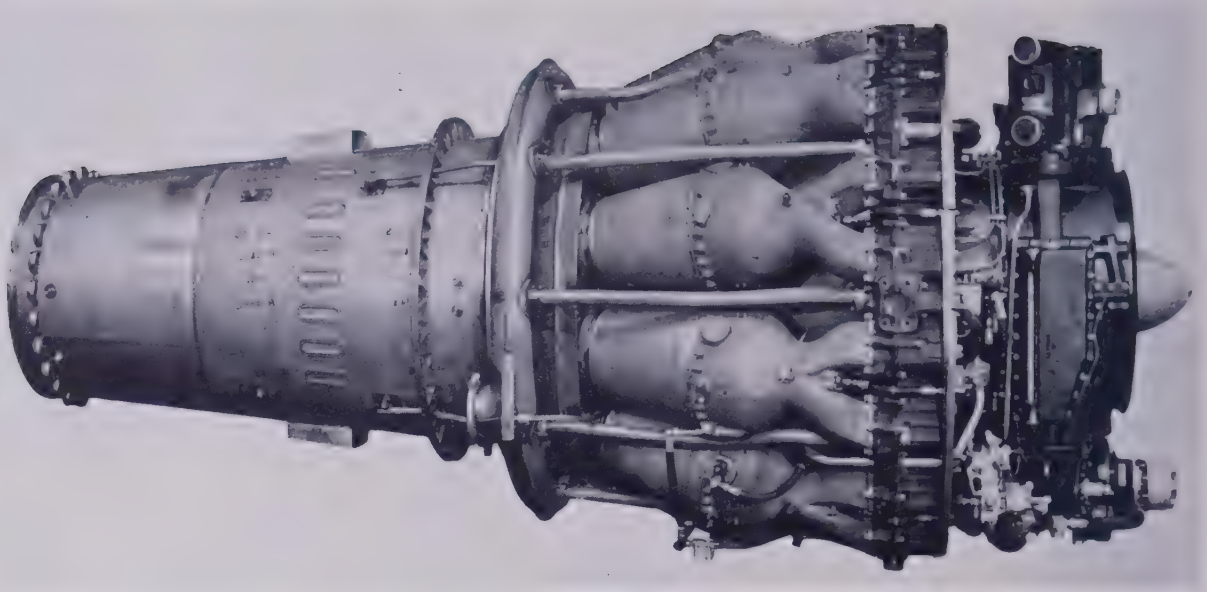
THE DE HAVILLAND GHOST 50.

Although larger than the Goblin, the Ghost has the same basic features and simple layout of the lower-powered engine, including a single-sided impeller, a single rigid rotor assembly, straight-through combustion, single-stage turbine and cantilever mounting.

TYPE.—Centrifugal-flow turbojet with single-stage turbine.

COMPRESSOR.—Single-stage centrifugal compressor with forged aluminium-alloy single-sided 19-vane impeller. Aluminium-alloy casing and two-piece magnesium-alloy diffuser with 20 tangential outlets. Rotative assembly rims on one ball and one roller (rear) bearing. Compression ratio 4.5 : 1. Air mass flow 88 lb. (40 kg.) per sec. at 10,250 r.p.m. at sea level.

COMBUSTION CHAMBERS. Ten straight-flow chambers each containing a concentrically-mounted perforated flame tube. Duplex fuel injection nozzle in front end of flame tube. Around each nozzle is a small perforated shroud admitting 30% of the air flow for primary combustion. Remainder of air passes around front end of



The de Havilland Ghost 50 turbojet engine which has a static thrust rating of 5,050 lb. (2,290 kg.).

flame tube and enters it through the perforations.

FUEL SYSTEM.—Dual manifold type. Two Lucas multi-plunger variable-stroke fuel pumps with overspeed governors and relief valves. Lucas baro-metric pressure control, throttle valve, shut-off cock, low and high-pressure fuel filters and Lucas burners are fitted.

FUEL.—Normal kerosene and gasolene turbine fuels.

TURBINE.—Single-stage turbine. Turbine disc of alloy steel has 97 inserted solid blades of Nimonic 90. Both sides of disc cooled by air tapped from compressor. Cast steel shroud has 80 inserted nozzle guide vanes of Nimonic 80.

JET PIPE.—Steel outer casing and fixed inner cone. Sheet steel insulating shroud with air space between it and outer casing.

LUBRICATION.—Main bearings pressure lubricated by two Tecalemit Micro pumps. Scavenging pump and Tecalemit filter.

STARTING.—Rotax turbo or electric starter.

DIMENSIONS.—
Max. diameter 53 in. (1,346 mm.).
Overall length to rear flange of exhaust cone 121 in. (3,073 mm.), standard exhaust cone being 51 in. (1,295 mm.) long to which is added 14 in. (35.5 cm.) for the propelling nozzle and cuff.

NET DRY WEIGHT.—
2,209 lb. (1,000 kg.) ± 2½%.

RATING.—
Max. static thrust 5,050 lb. (2,290 kg.) at 10,250 r.p.m.

CONSUMPTION (at max. static thrust).—
1.14 lb./lb. thrust/hr. (1.14 kg./kg. thrust/hr.) at sea level.

THE DE HAVILLAND GHOST 50 Mk. 2.

This engine is similar to the Ghost 50 but is fitted with water/methanol injection to restore take-off thrust at ISA + 10 per cent. and above. Four Ghost 50 Mk. 2 engines power the Comet Series 1A airliner.

THE DE HAVILLAND GOBLIN 35.

TYPE.—Centrifugal-flow turbojet with single-stage turbine.

COMPRESSOR.—Single-stage centrifugal compressor with single-sided impeller. Compression ratio 3.67 : 1. Impeller fabricated from heat-treated aluminium-alloy stamping, has 17 vanes and is 31 in. (78.74 cm.) in diameter. Pivot shaft is shrunk in and bolted to front face of impeller and carries bevel gear which drives accessory shaft. Rotative assembly runs in two ball-bearings, the rear in a sliding housing to allow for rearward expansion. Bearings lubricated by metered oil flow from two metering pumps driven by accessory shaft. Rear bearing is air-cooled by air bled from diffuser.

COMPRESSOR HOUSING.—In three sections. Front section of aluminium-alloy is a ribbed unit forming the two entry orifices and carries front bearing of rotor assembly and all accessories with their bevel-drive gears. Other two sections in magnesium-alloy bolted together to form diffuser, incorporating cascade guide vanes to smooth flow through right angle to combustion heads. Conical steel casing forms main lengthwise member of engine structure. Small end of centre cone is fixed to rear bearing housing just in front of turbine disc.

COMBUSTION CHAMBERS.—Sixteen straight-flow chambers with upstream ends bolted to rear face of diffuser chamber and downstream ends a sliding fit, with piston ring type seals, in turbine nozzle junction-box assembly. Combustion chamber outer casing in two parts, front half being an aluminium-alloy die casting and rear half a mild steel deep drawing. Flame-tube in two parts fabricated from 20 s.w.g. Nimonic 75.

FUEL SYSTEM.—Fuel is fed from aircraft fuel-system by immersed pump to engine rotary type fuel pump. Pump is rated at 585 Imp. gallons (2,657 litres) per hour at 1,000 lb./sq.in. (70.3 kg./cm.²) at 3,500 r.p.m.-10,500 r.p.m. engine speed. From pump, fuel passes through fuel control containing metering orifice, area of which is controlled by a metering needle which is so calibrated that equal movements of pilot's throttle will give equal increments of thrust. From fuel control box fuel passes to a barometric pressure control, a fuel accumulator, and automatic starting valve and into burner supply ring. 16 burners, of fixed orifice type, are inserted into combustion chambers through bosses cast in diffuser casing and are connected by flexible pipes to fuel supply ring.

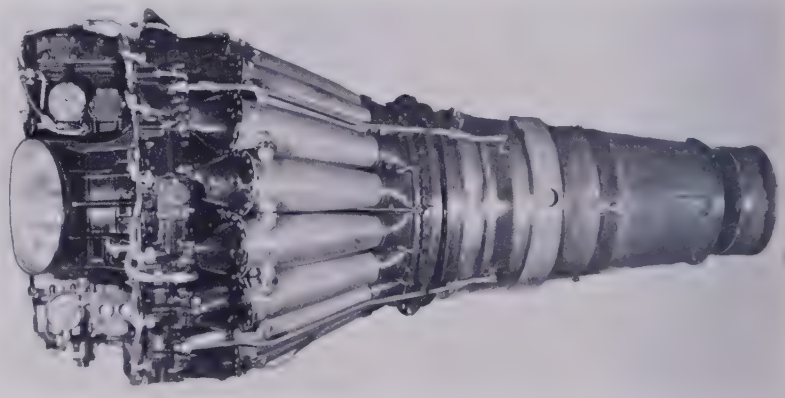
FUEL.—Normal kerosene and gasoline turbine fuels.

TURBINE.—Single-stage turbine. Turbine disc of special D.12 steel with 83 blades of Nimonic 80A mechanically attached in serrated slots broached in periphery of disc. Turbine ring separated from main casing by cylindrical sheet metal skirt which connects nozzle ring at its inner periphery with conical centre casing about half-way along its length, and by diaphragm plate which connects nozzle with rear bearing housing which in conjunction with reflector plate, shields rear bearing from high turbine temperatures. Nozzle blades are drop stampings in Nimonic 80.

JET PIPE.—Sheet steel exhaust cone bolted to turbine shroud-ring tapers to an orifice 16¾ in. (41.6 cm.) in diameter. Within jet pipe is an inner cone of sheet steel supported by two pairs of radial streamlined stays. Two of front stays are used to transmit air from diffuser casing to rear of turbine disc. Annular heater-muffs for warming aircraft cabins, guns and, in case of arctic operation, oil sump in front of engine, are welded on to outside of jet pipe. Pipe is finally enclosed in cowling through which air for cooling and insulating is drawn rearwards by suction of jet itself. Jet-pipe temperatures 710°C. maximum, 610°C. maximum continuous.

LUBRICATION.—Oil sump of about 12 pints (6.825 litres) capacity, bolted on to bottom accessory-drive gear-box on front casing. Gear-type pressure pump delivers oil to accessories and their drives and two metering pumps attached to and fed by pressure pump, feed the two bearings of rotor assembly. Oil from compressor end-bearing returns to sump while that from turbine end is drained to waste at a common drain box. Normal oil pressure at cruising r.p.m. is 35-45 lb./sq. in. (2.45-3.2 kg./cm.²) at 8,700 r.p.m. Maximum oil consumption 2 pts./hr.

STARTING.—Interconnected fuel and ignition system by which rotor is slowly spun up to a speed where sufficient air flows through to ensure ignition when fuel is admitted. When this stage is reached automatic starting valve allows fuel to be injected into burners from fuel accumulator. Igniter-plugs in two combustion chambers are



The de Havilland Goblin 35 turbojet engine.

automatically energised. Interconnecting elbows between all chambers ensure propagation of flame round engine and serve as pressure equalisers during normal running.

DIMENSIONS.—
Max. diameter 49.85 in. (1,267 mm.).
Installed diameter (Vampire) 54 in. (1,370 mm.).
Length to rear flange of standard exhaust cone 100.5 in. (2,550 mm.).

NET DRY WEIGHT.—
1,629 lb. (739.5 kg.) + 2½%.

RATINGS.—
Max. static thrust 3,500 lb. (1,589 kg.) at 10,750 r.p.m.
Max. continuous 3,000 lb. (1,363 kg.) at 10,250 r.p.m.
Economical cruising 2,320 lb. (1,043 kg.) at 9,500 r.p.m.
Idling 155 lb. (70 kg.) at 3,000 r.p.m.

CONSUMPTION.—
Sea level static at 10,750 r.p.m. 1.16 lb./lb./hr. (1.16 kg./kg./hr.) at 9,500 r.p.m. 1.20 lb./lb./hr. (1.20 kg./kg./hr.).

THE DE HAVILLAND SPRITE.

The Sprite is a liquid-fuel cold rocket motor of 5,000 lb. thrust intended for semi-permanent installation on transport or military aircraft requiring regular or occasional take-off assistance.

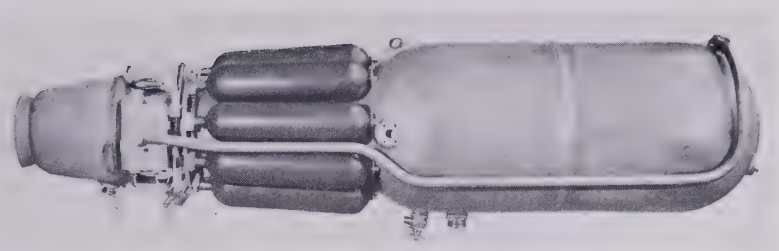
TYPE.—Liquid-fuel cold rocket.

CONSTRUCTION.—The motor comprises a cylindrical reaction chamber combined with convergent-divergent nozzle; a cylindrical reservoir with hemispherical ends for hydrogen peroxide; nine compressed-air cylinders arranged axially about the middle of the motor; a permanganate reservoir surrounding the nozzle, and a group of control valves disposed about the combustion chamber.

OPERATION.—Compressed air at 500 lb./sq. in. (35.15 kg./cm.²) feeds the two propellants, *via* solenoid-operated valves to the combustion chamber, where chemical interaction breaks down the hydrogen peroxide into water (in the form of high-pressure steam) and oxygen. Two buttons in the cockpit allow instantaneous starting either at full thrust or at a reduced flow (750 lb. = 340.5 kg. thrust) for checking operation of the unit. Control is exercised by throttling the compressed-air supply which forces the propellants to the combustion chamber.

WEIGHTS.—
Weight empty 350 lb. (159 kg.).
Propellants and air 575 lb. (261 kg.).
Operating weight 925 lb. (420 kg.).

PERFORMANCE.—
Rated continuous thrust 5,000 lb. (2,270 kg.).
Total impulse 55,000 lb./sec. (25,000 kg./sec.).



The de Havilland Sprite cold rocket motor.

THE DE HAVILLAND SUPER SPRITE.

The Super Sprite is an enlarged military development of the Sprite previously described. The principle of operation of the two units is similar except that, unlike the Sprite, which uses liquid potassium permanganate as one of the two propellants, the Super Sprite employs a solid catalyst, suspended inside the mixing chamber, to break down the hydrogen peroxide into gaseous steam and oxygen. This ensures a smokeless exhaust.

The Super Sprite is also fitted with petrol or kerosene injection to boost the rocket thrust, either in magnitude or duration.

The Super Sprite weighs 600 lb. (272 kg.) empty and develops a normal maximum thrust of 4,000 lb. (1,816 kg.). Its normal duration is 40 seconds.

NAPIER

D. NAPIER & SON, LTD.

HEAD OFFICE: ACTON, LONDON, W.3.
WORKS: ACTON, LONDON, W.3., AND EAST LANCASHIRE ROAD, LIVERPOOL, 10.

Directors: Sir George H. Nelson (Chairman), Brig. General Wade H. Hayes, O.B.E., P. Horsfall, H. G. Nelson, A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., Air Vice-Marshal Sir Conrad Collier, K.C.B., H. Sammons, C.B.E., M.I.Mech.E., F.R.Ae.S. (Managing).

When the evolution of the gas turbine engine foreshadowed the obsolescence of the piston engine the Napier Company embarked on a programme of gas turbine design and development.

The first of the new Napier engines to be announced was the Naiad, a 1,500 h.p. turboprop engine with twelve-stage axial-flow compressor and a two-stage turbine. A coupled Naiad consisting of two single engines side-by-side and driving co-axial contra-rotating airscrews through a common gear box was also announced. Both these engines have been described in previous editions.

Recent Napier power-plant developments include the Nomad compounded engine and the Eland turboprop engine, which develops 3,000 e.h.p. Details of both these engines follow.

THE NAPIER NOMAD.

The Nomad was designed to provide an aero-engine which would have the lowest possible fuel consumption under any operating conditions. This has been achieved by compounding the simplest form of two-stroke diesel engine with a gas turbine, and transmitting the power through a propeller. This type of engine also enables a wide range of fuels to be used, such as diesel fuel, kerosene and wide-cut gasoline. The low fuel consumption (as compared with a gas turbine, used either for driving a propeller or as a jet engine) is achieved by the use of a high compression ratio and a high expansion ratio, which is made possible by the combination of the diesel engine with a gas turbine.

The Nomad consists of a simple valveless two-stroke diesel engine to which is added a turbine-compressor set. The axial-flow compressor is on a common shaft with a multi-stage exhaust turbine and the turbine-compressor set thus formed is coupled mechanically to the compression-ignition engine through suitable gearing. The power of the compression-ignition engine and the surplus power available from the exhaust gas turbine are transmitted to a common single-rotation propeller shaft by a reduction-gear in the nose of the engine assembly. The Nomad is controlled by a single pilot's lever.

DIMENSIONS.—
Length 119 in. (302 cm.).
Frontal area 19.25 sq. ft. (1.78 m.²).

WEIGHT.—
3,580 lb. (1,625 kg.).

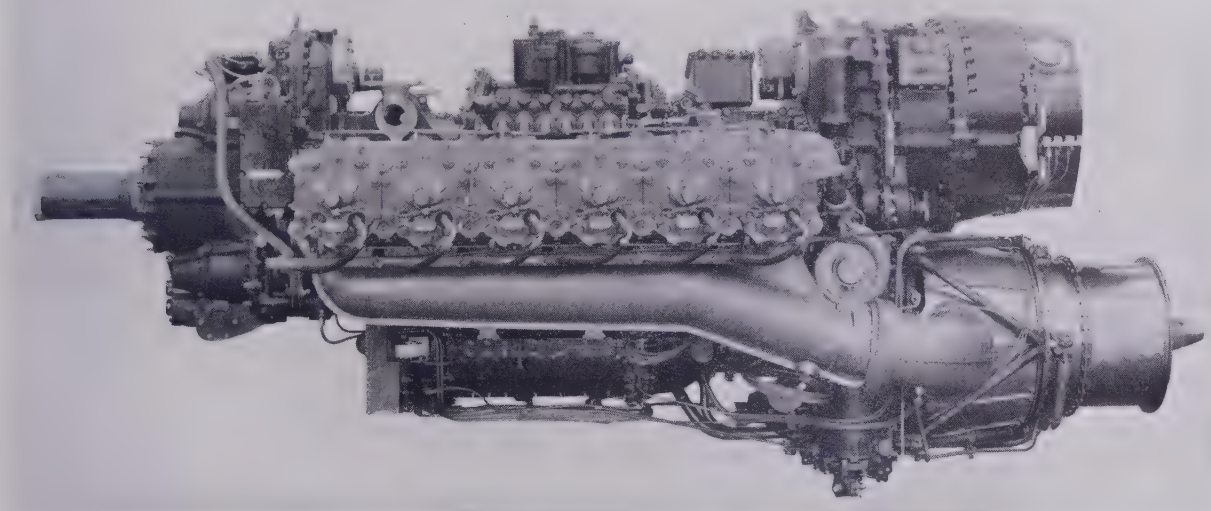
PERFORMANCE.—
Max. output 3,135 e.h.p.

FUEL CONSUMPTION.—
.33 to .35 lb. (.149 to .158 kg.)/e.h.p./hr.).

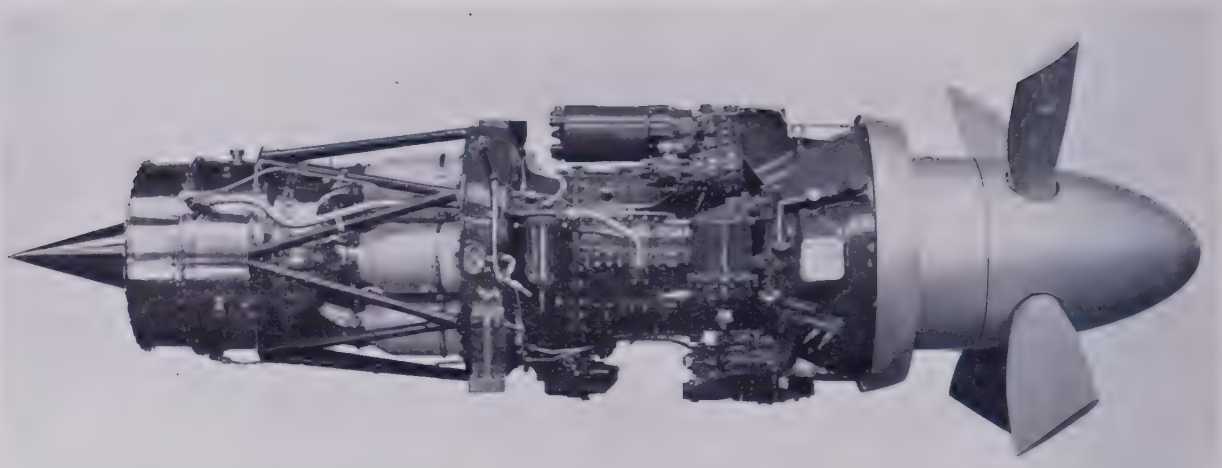
THE NAPIER ELAND.

TYPE.—Turboprop engine with ten-stage axial compressor, six combustion chambers and three-stage turbine.

PROPELLER DRIVE.—Compound epicyclic reduction gear, incorporating hydraulic torquemeter, driven from extension of compressor



The Napier Nomad compounded engine which has a maximum output of 3,125 e.h.p.



The Napier Eland turboprop engine which develops 2,690 s.h.p. plus 825 lb. (318 kg.) jet thrust.

shaft. Following gear ratios can be provided: .0714, .0838, .0912 or .0972.

AIR INTAKE.—Annular, forward facing, immediately behind propeller.

COMPRESSOR.—Ten-stage axial compressor. Aluminium-bronze blades. Aluminium compressor casing cast in halves. Compressor shaft on ball bearing (front) and roller bearing (aft). Compression ratio 7 : 1.

COMBUSTION CHAMBERS.—Six detachable tubular chambers.

FUEL SYSTEM.—Single-lever control operates an interconnected propeller governor and fuel metering unit, with automatic compensation for variations in altitude and forward speed. A hydraulic type torquemeter, incorporated in reduction gear box, and a feathering pump actuated by the torquemeter provide for automatic feathering.

FUEL GRADE.—Wide-cut gasoline (D.E.R.D. 2486) or Aviation turbofuel (D.E.R.D. 2482).

TURBINE.—Three-stage axial-flow. Turbine shaft supported at front end by gear type coupling driving compressor, and at rear end by ball bearing.

JET PIPE.—Fixed nozzle type. Pipe and cone of Nimonic 75.

ACCESSORY DRIVES.—Accessories are mounted on reduction gear casing and are driven from front of compressor shaft. A splined shaft is provided for an aircraft accessory gear box and is situated above front end of compressor. Pressure oil pump, torquemeter pump and scavenge pumps are driven from a shaft at rear end of propeller shaft and are mounted below engine. Fuel pump, tachometer and propeller governor are driven from accessory gear-box drive and are mounted on top of engine.

LUBRICATION SYSTEM.—Pressurised jet feeds to bearings and gearing. Oil pressure and main scavenge pumps are of gear type, auxiliary scavenge pumps for compressor and turbine bearings are of vane type. All these components are manufactured by Napier. Normal oil pressure 80 lb./sq. in. (5.6 kg./cm.²).

OIL SPECIFICATION.—Synthetic oil (D.E.R.D. 2487).

MOUNTING.— Single - plane type. Three mounting pads on support plate at rear of compressor.

STARTING.—Electric starter, on top front end of compressor casing, drives engine *via* accessory gear-box drive.

DIMENSIONS.—
Diameter $36\frac{1}{16}$ in. (91.6 cm.).
Length overall (from front end of propeller shaft to turbine exit flange) $121\frac{5}{8}$ in. (308.9 cm.).
Frontal area 7.1 sq. ft. (0.66 m.²).

WEIGHT.—
Dry 1,575 lb. (715 kg.).
Complete with accessories 1,661 lb. (754 kg.).

PERFORMANCE (S/L. Static I.C.A.N. conditions).—
Max. take-off 2,690 s.h.p., plus 825 lb. (374.5 kg.) net jet thrust at 12,500 r.p.m. (3,007 equivalent h.p.).
Max. continuous 2,070 s.h.p., plus 700 lb. (317.8 kg.) net jet thrust, at 12,000 r.p.m. (2,340 equivalent h.p.).
Max. recommended cruising 1,665 s.h.p., plus 585 lb. (265.6 kg.) net jet thrust, at 11,500 r.p.m. (1,890 equivalent h.p.).

FUEL CONSUMPTIONS.—
At max. T.O. output .625 lb. (.28 kg.)/e.h.p./hr.
At max. continuous output .659 lb. (.29 kg.)/e.h.p./hr.
At max. recommended cruising .688 lb. (.31 kg.)/e.h.p./hr.

OIL CONSUMPTION.—
2 pints (1.1 litres) per hour.

ROLLS-ROYCE

ROLLS-ROYCE, LTD.

HEAD OFFICE: DERBY.

WORKS: DERBY, CREWE AND GLASGOW.

LONDON OFFICE: 14-15, CONDUIT STREET, W.1.

Established: March 15, 1906.

Directors: The Rt. Hon. Lord Hives, C.H., M.B.E. (Chairman and Joint Managing Director), Brig.-General H. K. M. Kindersley (Deputy Chairman), A. G. Elliott, C.B.E. (Joint Managing Director and Chief Engineer), Harold Peake, M.A., W. T. Gill, The Hon. M. F. P. Lubbock, Dr. F. Llewellyn Smith, M.Sc., W. A. Robotham, M.I.Mech.E. and J. D. Pearson Wh.Sch., B.Sc., M.I.Mech.E., A.F.R. Ae.S., M.I.P.E. (Chief Executive, Aero-engine Division).

At the end of 1941, under instructions from the Ministry of Aircraft Production, Rolls-Royce undertook the development and manufacture of the Whittle-type engine in conjunction with Power Jets, Ltd. and the Rover Company.

The first Rolls-Royce version of the Whittle W2B/23 jet-propulsion engine passed its 100-hour type test in April, 1943. It gave a thrust of 1,700 lb. (772 kg.) for a weight of 850 lb. (386 kg.). It was named the Welland, being the first of the Rolls-Royce "River" class of jet-propulsion engines, this name being chosen to give the idea of flow associated with jet-propulsion. Production deliveries of the Welland to the R.A.F. began in May, 1944, when this engine also passed its first 500-hour type test and went into service with 180 hours between overhauls.

In March, 1942, the Rover Company ran its prototype W2B/26 engine which was based on a Power Jet's design for a "direct-flow" combustion engine. The development of this engine was pursued by the Rover Company until Rolls-Royce took over the Rover factory at Barnoldswick in April, 1943. The W2B/26 served as the prototype for the Derwent 1 and the first Rolls-Royce engine of this type, completed in three and a half months, was on test in July, 1943. This engine was intended as a replacement for the Welland engine in the Gloster Meteor twin-jet fighter. The Meteor first flew with two Series 1 Derwent engines in March, 1944, each unit developing a thrust of 2,000 lb. (907 kg.) for a weight of 920 lb. (418 kg.). The current Derwent Series 8 engine which powers the Meteor 8 is rated at 3,600 lb. (1,635 kg.).

The Nene, a parallel development of the Derwent which it resembles in general features and layout, was designed and built in $5\frac{1}{2}$ months and was first run in October, 1944. Designed for a static thrust of 4,000 lb. (1,814 kg.) at 12,300 r.p.m., performance was later improved and cleared for flight at 5,000 lb. (2,268 kg.) at 12,300 r.p.m.

Among the aircraft fitted with the Nene are the Supermarine Attacker and Type 535; the Hawker Sea Hawk; the Avro Ashton; and the Australian-built D.H. Vampire 30.

The Avon engine, the first Rolls-Royce axial-flow engine to go into production, is being manufactured by the Rolls-Royce group of factories, as well as by the Engine Division of the Bristol Aeroplane Company, Ltd., D. Napier & Son, Ltd., and The Standard Motor Company, Ltd. It is also being manufactured under licence in Australia, Belgium, France and Sweden.

The Tay engine, designed by Rolls-Royce, has been jointly developed by Rolls-Royce and Pratt & Whitney. A development of the Nene, the rated thrust of the Tay is 6,250 lb. (2,840 kg.). The Tay is being built under licence in the U.S.A. by Pratt & Whitney under the designation J-48, and also in France by Hispano-Suiza.

The Nene is also manufactured under licence in Australia, and the Derwent in Belgium and the Argentine Republic.

Four Rolls-Royce Dart turboprop engines form the power-plant of the Vickers Viscount which was the World's first turboprop-powered airliner to go into regular service.

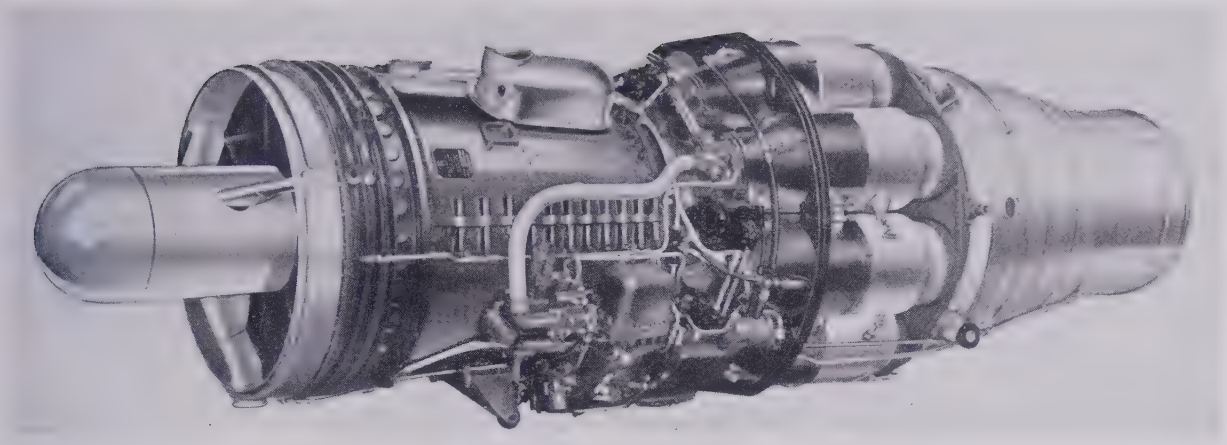
THE ROLLS-ROYCE CONWAY

The Conway is an axial-flow engine of the "by-pass" type, the existence of which may be mentioned, but concerning which no details were available for publication at the time of closing for press.

THE ROLLS-ROYCE AVON.

The Avon is an axial-flow engine of which only a few details are available for publication. It is in large-scale production in several versions for many types of installations in bombers, fighters and in civil aircraft. The following are the variants of which mention is permitted :—

RA.3 (Mk. 1). Basic S/L. s.t. rating 6,500 lb. (2,950 kg.) at 7,800 r.p.m. Production began in June, 1950. Powers the English Electric Canberra B. Mk. 2. Dimensions: diameter 42 in. (1,067 mm.), overall length (including exhaust unit)



The Rolls-Royce Avon RA.7 axial-flow turbojet engine which has a rated thrust of 7,500 lb. (3,405 kg.).

129.85 in. (3,298 mm.), frontal area 9.6 sq. ft. (0.89 m.²). Weight (dry) 2,240 lb. (1,016 kg.) approximately. Fuel consumption (take-off) 0.88 lb./lb. s.t./hr. (0.88 kg./kg. s.t./hr.). Oil consumption less than 1.5 pints (0.85 litres) per hour.

Mk. 501. Civil version of RA.3. Powers D.H. Comet Series 2.

RA.7. Basic S/L. s.t. rating 7,500 lb. (3,405 kg.) at 7,950 r.p.m. Type-tested in March, 1952. Thermal anti-icing. Seven versions of RA.7 rating engine in production. First deliveries to aircraft manufacturers in September, 1952. Built under licence in Australia, etc. Engines of this rating power the Supermarine Swift, Hawker Hunter F. Mk. 1, Vickers Valiant, and the Australian-built Sabre and Canberra. Dimensions: diameter 42.225 in. (1,075.2 mm.), overall length (including exhaust unit) 110 in. (2,794 mm.) approximately, frontal area 9.7 sq. ft. (0.94 m.²). Weight (dry) 2,460 lb. (1,116.8 kg.) approximately. Fuel consumption (take-off) 0.92 lb./lb. s.t./hr. (0.92 kg./kg. s.t./hr.). Oil consumption less than 1 pint (0.56 litres) per hour.

RA.7R. RA.7 with re-heat. Type tested in January, 1953, at 9,450 lb. (4,290 kg.) S/L. static thrust at 7,950 r.p.m. with re-heat. Variable exhaust nozzle. Overall length 120 in. (3,048 mm.). Other dimensions and dry weight as RA.7.

RA.9. Same rating as RA.3. In production.

RA.14. A new engine which was type-tested in April, 1953, at a thrust of 9,500 lb. (4,310 kg.) without re-heat. Since then the engine has been continuously and progressively developed in flight to give powers well into five figures. For fighter installation the RA-14 will be fitted with re-heat, or after-burning. Production and delivery of the RA.14 began only twenty months after the running of the first engine.

RA.16. A de-rated RA.14 for civil use. Type-tested at 9,000 lb. (4,090 kg.) thrust, but this figure has since been substantially exceeded. Will power the D.H. Comet Series 3.

No other details of the Avon are available for publication.

THE ROLLS-ROYCE DERWENT 8.

TYPE.—Centrifugal-flow Turbojet with single-stage double-entry compressor and single-stage turbine.

COMPRESSOR.—Single-stage double-entry centrifugal compressor with double-sided impeller 24.5 in. (525 mm.) in diameter. An 18-vane diffuser has a throat area of 56.8 sq. in. (245 cm.²). Compression ratio 4.19 : 1 static, at take-off. Rotor assembly supported on three bearings.

COMBUSTION CHAMBERS.—Nine straight-flow combustion chambers with internal concentrically-mounted flame tubes. Interconnectors between the chambers to equalise pressure and to ignite the fuel in adjoining tubes when starting up. Two igniter plugs (in chambers 3 and 8).

FUEL SYSTEM.—Engine-driven positive-displacement multi-plunger swashplate pump, with built-in overspeed governor, draws fuel through a fabric-element low-pressure filter and delivers it to fixed orifice type burners, one in each combustion chamber, via a throttle control valve and ring manifold. Pump delivery pressure is variable and is controlled by a built-in servo system actuated by a separate barometric pressure control containing a capsule which is subjected to nacelle pressure.

FUEL.—Aviation Turbofuel (D.Eng.R.D. 2482).

TURBINE.—Single-stage axial-flow turbine with 54 blades. Direction of rotation anti-clockwise (viewed from rear).

ACCESSORIES.—Engine accessories, including fuel and oil pumps, mounted on wheelcase at front of engine, together with an electric starter motor. Drive provided in wheel-case for accessory gear-box.

LUBRICATION SYSTEM.—Oil tank (22 pints = 12.5 litres capacity) mounted on engine wheelcase. A gear-pump supplies pressure oil to main bearings and wheel-case. Front bearings drain into wheel-case, which is scavenged by upper unit of a twin gear-type scavenge pump. Lower unit scavenges directly the centre and rear main bearings. Combined delivery from twin scavenge pump is discharged into the tank. No oil cooler fitted. Specification DEF.2001 oil is used.

MOUNTING.—Two trunnions mounted on horizontal centre-line of the compressor casing, and a torsionally-free diamond frame with link connected and two aircraft pick-up points located 40 in. (1,016 mm.) aft of two main trunnions.

DIMENSIONS.—
Max. diameter 43 in. (1,092 mm.).
Overall length 83.1 in. (2,108 mm.).
Frontal area 10.1 sq. ft. (0.94 m.²).

WEIGHT DRY (including oil tank).—
1,280 lb. (580 kg.) approx.

PERFORMANCE.—
Take-off rating 3,600 lb. (1,633 kg.) thrust at 14,700 r.p.m. at sea level.
Max. continuous rating 3,090 lb. (1,402 kg.) thrust at 14,100 r.p.m. at sea level.
Idling rating 120 lb. (54 kg.) thrust at 3,500 r.p.m.

CONSUMPTIONS.—
Fuel consumption (cruising) 1.03 lb./lb. thrust/hr. (1.03 kg./kg. thrust/hr.).
Oil consumption 1 pint (0.568 litres) per hour max.

THE ROLLS-ROYCE NENE.

Several versions of the basic Nene engine are now in service, the main differences between which are as follows:—

Mk. 3. Electric starter motor and two torch igniter units. Powers the Supermarine Attacker F. Mk. 1.

Mk. 10. Similar to Mk. 102 but a larger wheelcase is provided to mount and drive aircraft accessories. Engine adapted for installation in Canadair Silver Star (Lockheed T-33) trainer.

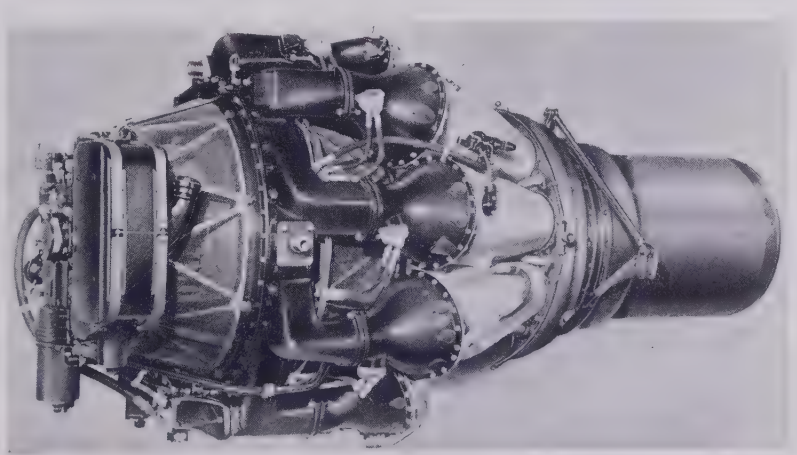
Mk. 101. Fitted with front panel of plenum chamber, horizontal gearbox drive, Plessey turbo-starter and two high-energy igniters and a divided jet pipe. This last-mentioned item has the effect of lowering the thrust by a 100 lb. (45.4 kg.) to 5,000 lb. (2,266 kg.). Powers the Hawker Sea Hawk.

Mk. 102. Installationally similar to the Mk. 3 but incorporating latest detail design changes. Electric starter motor and two high energy igniters. Powers the Supermarine Attacker F.B. Mk. 2.

The description and specification given below are applicable generally to all marks.

TYPE.—Centrifugal-flow turbojet with single-stage double-entry compressor and single-stage turbine.

COMPRESSOR.—Single-stage double-entry centrifugal compressor with double-sided impeller. Impeller has 29 vanes per side with separate forged aluminium rotating guide vanes machined all over. Compression ratio (static) 4 : 1. Rotor assembly, consisting of impeller, turbine and shafts,



The Rolls-Royce Derwent 8 turbojet engine.

supported on three bearings. End bearings of roller type and centre bearing a deep-grooved ball bearing. Mounted on shaft between compressor and centre bearing is a fan which directs cooling air on to and under centre and rear bearings and face of turbine disc.

COMBUSTION CHAMBERS.—Nine straight-flow combustion chambers each consisting of an outer casing, a perforated flame tube and duplex burner. Flame igniters in Nos. 3 and 8 air casings.

FUEL SYSTEM.—Twin pumps of oscillating multi-plunger type with built-in overspeed governors draw fuel through filter mounted under wheelcase and deliver to burners via throttle control valve, high-pressure shut-off cock and pressurising valve. Barometric pressure control acts on servo mechanism in high-pressure pump to vary pump delivery according to altitude requirements. Acceleration control unit retards fuel flow to prevent over fuelling during accelleration periods.

FUEL.—Aviation Turbofuel (D.Eng.R.D.2482).

TURBINE.—Single-stage axial flow turbine comprising solid steel disc and 54 blades in Nimonic 80 nickel chromium alloy. Blades secured in periphery of turbine disc by "fir-tree" type serrated roots. Wheel and shaft bolted together. Jet pipe temperature 690°C. approx.

JET PIPE.—Consists of jet pipe and propelling nozzle. Exhaust cone of fixed length but jet pipe varies in length according to installation requirements of aircraft. These parts mainly double-walled, with space between packed with Alfol heat-insulating material. Air heating jackets can be arranged around jet pipe for gun or cabin heating.

ACCESSORY DRIVES.—Wheelcase on front of engine, driven from forward impeller shaft, houses drives for aircraft accessory gear-box, tachometer generator and twin fuel-pumps. Alternative drive positions for aircraft accessory gear-box, upper horizontal drive and upward inclined drive, suiting Rotol S.G.1 series of gear-boxes. Speed of gear-box drives 0.421 engine speed. Cabin supercharger driven from accessory gear-box. 24-volt electric starter motor mounted on port side of wheelcase.

LUBRICATION SYSTEM. Continuous circulation system, with main bulk of oil contained in sump formed by lower part of wheel case. Sump houses pressure and scavenge oil-pumps, two gauze scavenge oil filters. Puralotor high-pressure filter, pressure relief valve and de-aerator. Capacity of oil sump approx. 9 pints (5.7 litres). Specification DEF.2001 oil is used.

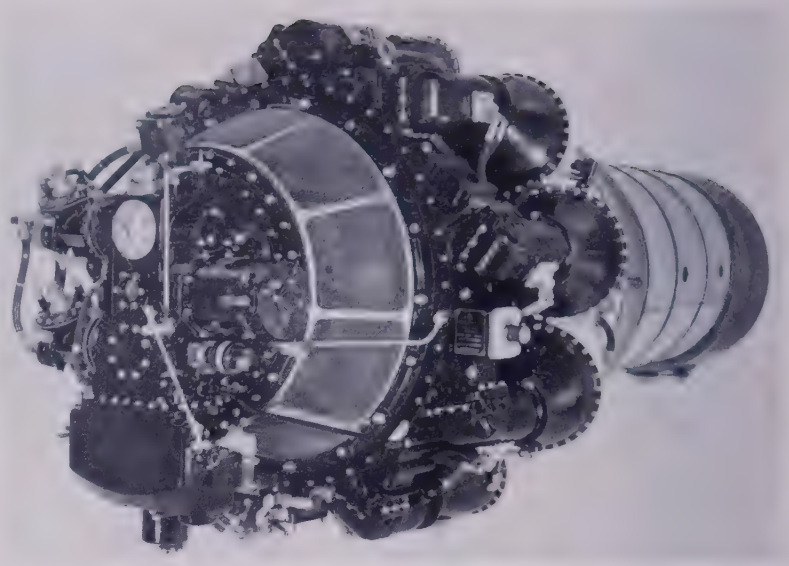
MOUNTING.—Range of standardised brackets designed to suit various types of installation with six alternative combinations of attachment points.

DIMENSIONS.—
Max. diameter 49.5 in. (1,258 mm.).
Overall length to exhaust cone flange 96.8 in. (2,960 mm.).
Length of jet pipe, to suit installation.
Frontal area 13.4 sq. ft. (1.24 m.²).

WEIGHT.—
Dry (including auxiliaries but excluding aircraft accessories and jet pipe) 1,660 lb. (754 kg.) approx.

PERFORMANCE.
Take-off and combat thrust rating 5,100 lb. (2,315 kg.) at 12,500 r.p.m. (static).
Max. continuous power 4,090 lb. (1,815 kg.) thrust at 11,800 r.p.m. (static).

CONSUMPTIONS (at max. T.O.).—
Fuel consumption 1.06 lb./lb. thrust/hr. (1.06 kg./kg. thrust/hr.).
Oil consumption 1 pint (0.568 litres) per hour (max.).



The Rolls-Royce Nene 3 turbojet engine.

THE ROLLS-ROYCE TAY.

The Tay engine was designed by Rolls-Royce to meet the requirement for a centrifugal-flow gas-turbine of greater thrust than existing Rolls-Royce engines of this type. The engine has been intensively developed at the Rolls-Royce factory in Derby and, in addition, complete engines have been shipped to the U.S.A. for development at the Pratt & Whitney plant in East Hartford, Connecticut. The joint work of the two companies resulted in the completion of official flight substantiation tests at the Pratt & Whitney plant of a Tay engine, having a basic power rating of 6,250 lb. (2,840 kg.) thrust.

The American development of this engine is now in production by Pratt & Whitney as the J-48 Turbo-Wasp. The Tay is also being built under licence in France by the Hispano-Suiza company.

THE ROLLS-ROYCE DART 505.

TYPE.—Turboprop with two-stage centrifugal compressor and two-stage turbine.

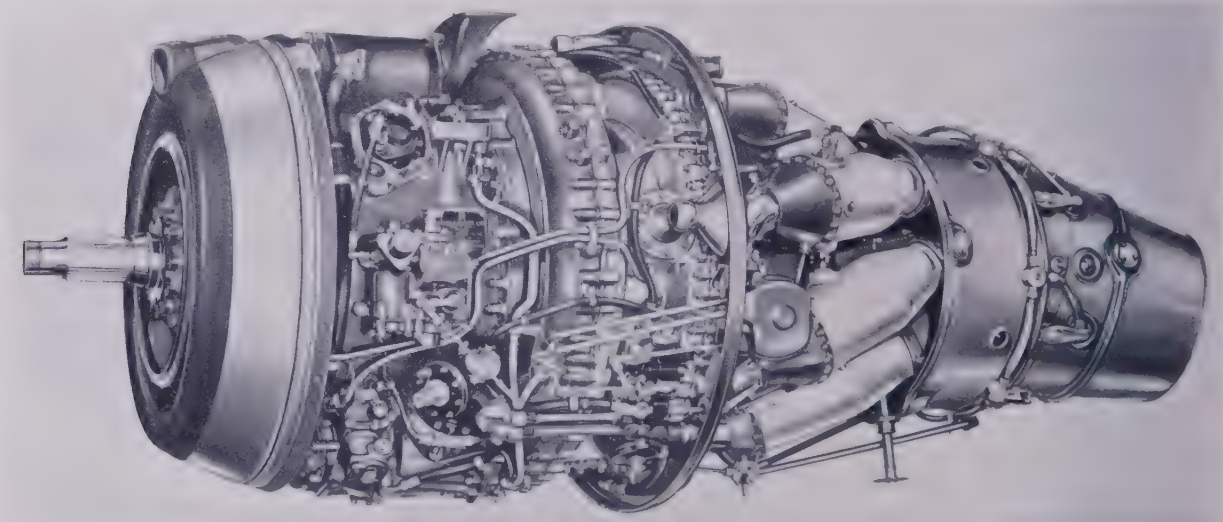
REDUCTION GEAR.—Double reduction gearing with helical high-speed train and final spur gear drive. The two gear trains connected by three layshafts. High-speed sun-wheel driven from forward end of impeller shaft with final drive through a large annulus splined to airscrew shaft. All gears and airscrew shaft carried in roller or ball bearings. Bevel gears from one of the layshafts provide drives to fuel and oil pumps and constant-speed unit. Bevel gear and engaging mechanism on sun-wheel shaft provide drive from starter motor. Reduction gear ratio 0.106 : 1.

AIR INTAKE.—Circular intake with annular duct leading to impeller eye of first-stage compressor. Oil tank around intake is cast integral with casing. Secondary air intake supplies air to oil cooler mounted on top of casing.

COMPRESSOR.—Two-stage centrifugal-flow compressor. Each impeller has nineteen vanes and steel rotating guide vanes. Mass air flow at maximum r.p.m. 20 lb./sec. (9.1 kg./sec.) at 5.5 : 1 compression ratio.

COMBUSTION CHAMBERS.—Seven straight-flow combustion chambers. Flame tubes in Nimonic 75 with fuel atomisers in front end of each tube for downstream injection. Torch igniters in Nos. 3 and 7 chambers. Chambers are interconnected to permit flame spread during starting.

FUEL SYSTEM.—Single multi-plunger variable-stroke injection pump delivers fuel to burners and torch igniters through flow



The Rolls-Royce Dart 505 turboprop engine which develops 1,400 s.h.p. plus 365 lb. (165 kg.) jet thrust.

control unit, which incorporates a filter, throttle valve, shut-off cock and barometric pressure control solenoid. Operation of control unit is function of intake pressure and throttle valve pressure drop, thus determining fuel/air ratio for all engine operating conditions. Fuel pressure at burners varies from 40 lb./sq. in. (2.81 kg./cm.^{2}) at idling speed to 920 lb./sq. in. (64.6 kg./cm.^{2}) at maximum power. Automatically-progressive injection of water/methanol used to restore take-off power under high ambient temperature conditions. System inter-connected mechanically with throttle lever to ensure that it can only be used at take-off r.p.m.

Turbine.—Two-stage axial-flow turbine, the two discs coupled and bolted to a single shaft which forms direct drive to compressor. First-stage turbine disc in Jessops G18B steel, second-stage disc in S.62 stainless steel. 131 blades on first stage turbine, 103 on second-stage. All blades of Nimonic 80 nickel chromium alloy, and secured on discs by "fir-tree" type serrated roots. Each turbine wheel cooled on both faces by air bled from compressor.

Exhaust Unit.—Airscrew thrust line coaxial with engine main shaft but exhaust unit can be either straight or have a slight inclination to suit installation. Unit comprises an outer shell which supports an inner cone on three struts enclosed in aerofoil-secton fairings to reduce turbulence and straighten gas flow at nozzle.

Accessory Drives.—An accessory gear-box drive is taken from the main-shaft centre-coupling immediately behind compressor through a train of gears, to a housing on top of intermediate casing; a universal coupling provides final drive to gear-box.

Lubrication.—Entirely self-contained. Integral oil tank (total capacity 38 pints = 22 litres) has two compartments, one for engine requirements and other for airscrew feathering. Gear pump supplies oil to all bearings and reduction-gear jets at nominal pressure of 30 lb./sq. in. (2.10 kg./cm.^{2}) and at nominal flow of 460 Imp. gallons (2,091 litres) per hour. Combined delivery from four scavenge pumps returned to tank *via* oil-cooler on top of intake casing. Pressure and scavenge pumps built into single housing and driven by common shaft.

Controls.—Only two cockpit controls, a throttle lever for varying power and a high-pressure cock for stopping engine. Throttle valve is interconnected with the airscrew controller and high-pressure cock is linked with airscrew feathering controls. Blades may be feathered by moving shut-off cock lever past the closed position; depression of an unfeathering button returns blades to fine pitch. To avoid undue load when starting, a cut-out connected with the airscrew prevents engine starting system from operating unless blades are in zero pitch. Safety device prevents airscrew from going into zero pitch unless aircraft weight is on landing-gear.

Mounting.—Four feet are provided at 90° on the horizontal and vertical centre-lines of compressor casing, although only three need be used. No rear mounting is required, but jet pipe if used requires separate mounting in airframe.

Dimensions.—
Length to exhaust cone 95.125 in. (2.416 mm.).
Diameter over cowling 37.9 in. (963 mm.).
Frontal area 7.9 sq. ft. (0.734 m.^{2}).

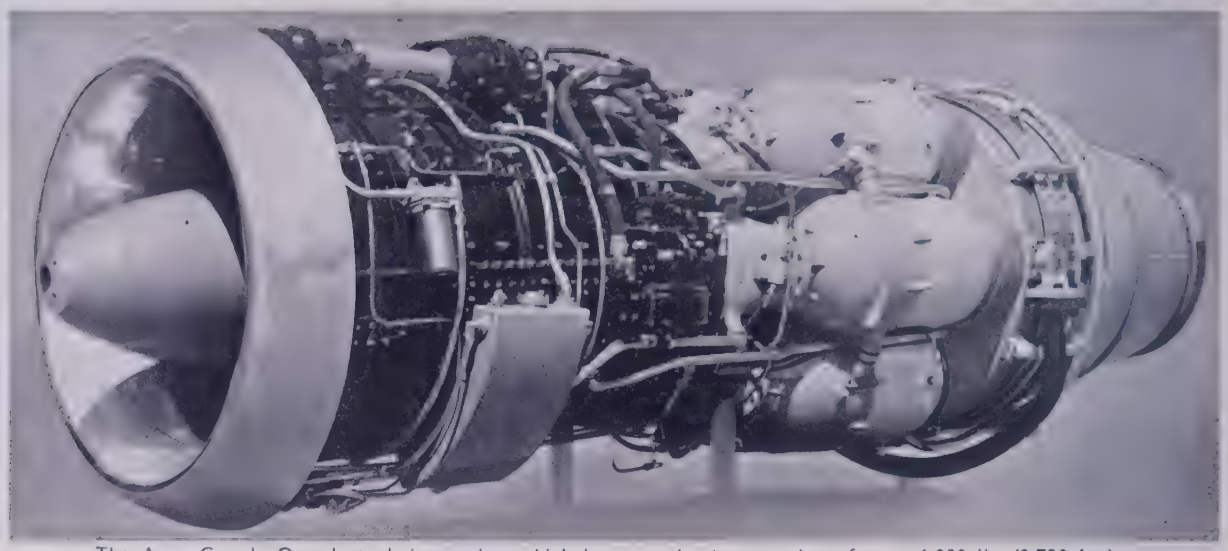
Weight (Dry).—
1,030 lb. (468 kg.).

Performance.—
Max. take-off (static) 1,400 s.h.p. plus 365 lb. (165 kg.) jet thrust at 14,500 r.p.m.
Max. continuous cruising rating (static) 1,120 s.h.p. plus 295 lb. (134 kg.) jet thrust at 14,000 r.p.m.
Normal idling 40 s.h.p. at 6,000 r.p.m.

Fuel Consumptions.—
At max. take-off (static) 1,165 lb. (529 kg.) per hour, at max. continuous cruise (static) 1,008 lb. (458 kg.) per hour

CANADA

AVRO



The Avro Canada Orenda turbojet engine which has a static thrust rating of over 6,000 lb. (2,720 kg.).

A. V. ROE CANADA, LTD., GAS TURBINE DIVISION.

HEAD OFFICE AND WORKS: Box 430, TERMINAL "A", TORONTO.

General Manager: T. S. McCrae.
Director of Engineering: Val Cronstedt.
Chief Engineer: D. W. Knowles.
Experimental Manager: M. G. Nix.
Comptroller: K. R. Church.

In 1945 the Hawker Siddeley Aircraft Co., Ltd. took over the Government-owned Victory Aircraft plant at Malton and formed A. V. Roe Canada, Ltd. In 1946 Avro Canada took over the Government-owned Turbo Research, Ltd., which had been formed in 1944 to engage in the research and development of the gas-turbine in Canada.

The first gas-turbine engine to be designed and manufactured in Canada, was the Avro Chinook, a development engine from which data was acquired for use in the design and construction of larger and more powerful engines for specific applications.

The first production engine developed by A. V. Roe Canada is the Orenda axial-flow turbojet engine which was designed and built for the Royal Canadian Air Force. It now powers the Avro CF-100 twin-engined two-seat all-weather fighter and the latest version of the Canadair Sabre single-seat day fighter.

For the large-scale production of the Orenda engine a new plant has been built at Malton and new research and testing facilities have been provided at Malton and Nobel. Among the principal sub-contractors are: Canadian Steel Improvement, Ltd. (turbine blades), Rotax (Canada) Ltd. (fuel systems), Cockshutt Plow (combustion chambers), and Light Alloys, Ltd. (magnesium castings and forgings).

THE AVRO ORENDA.

The Orenda ran for the first time in February, 1949, and within 8½ months of the first run the prototype engine had completed 750 hours of development flying without a major rebuild or overhaul.

The Orenda engine first flew as prime mover in a North American F-86A at the Edwards A.F.B., Muroc, California, in October, 1950. On June 20, 1951, the Avro Canada CF.100 two-seat all-weather fighter, for which the Orenda engine was specifically designed, made its first flight powered by two Orenda engines.

The Orenda is now in production. The following versions have been publicly announced:—

Series 1. Original design. First ran in February, 1949, thirty months after the design was initiated.

Series 2. First production version. Passed its type test in February, 1952. Modified to permit three-point suspension, to reduce weight and to improve airframe installation.

Series 8. Current production version. Modified compressor to improve acceleration characteristics. Passed type test in January, 1953. Powers the CF.100 Mk. 3.

Series 9. Same as Series 8. Powers the CF.100 Mk. 4.

Series 10. Same as Series 8. Powers the Canadair Sabre 5.

All the above engines are in the 6,000-6,500 lb. s.t. category. Further engines under development include the Series 11 (7,500 lb. = 3,400 kg. s.t.) and the Series 12 which will have a further thrust increase.

TYPE.—Axial-flow turbojet.

AIR INTAKE.—Annular intake surrounding nose bullet. Intake frame houses power take-off, supports electric starter and provides for attachment of debris guard and intake fairing. Radial struts of frame carry starter leads and various other engine services.

COMPRESSOR.—Ten-stage axial-flow compressor made up of blade discs mounted on internal drum. Pads on an annular duct at 8th stage are available for air bleed for aircraft services.

COMBUSTION CHAMBERS. — Six interconnected straight-through chambers each with a concentrically-mounted flame tube having a burner in the front end and discharging down-stream. Interconnectors between Nos. 1 and 2 and Nos. 5 and 6 chambers each carry torch igniter atomiser and igniter plug.

FUEL SYSTEM.—Fuel delivered by two Lucas high-pressure pumps through Bendix flow control unit, which embodies the air/fuel ratio controller, and a Lucas flow distributor valve. Lucas Duplex III burners.

FUEL.—3-GP-23a (MIL-F-5616 Grade JP-1) or 3-GP-22a (MIL-F-5624A Grade JP-4).

TURBINE. —Single-stage turbine consisting of an austenitic steel disc with nickel-chromium blades inserted in its periphery by "fir-tree" fixings. Centre and rear bearings and both faces of turbine disc cooled by compressor air bled from second and fifth stages and by leakage air from tenth stage peripheral seal.

JET PIPE.—Fabricated from stainless steel sheet with stainless steel flanges at front and rear. Bullet supported by four tubuler struts which pass through four large straightener vanes. Outer jet-pipe casing lagged with insulation blanket.

LUBRICATION.—Dry sump type. Pressure oil supplied to rotor bearings, gear boxes, front bearing seal and drive-shaft flexible coupling through ring main. Used oil collects in three separate sumps. Relatively cool oil from front sump is returned directly to tank while hot oil from two rear sumps returns to tank through cooler which uses engine fuel as coolant. Capacity of integral oil tank 13.5 Imp. pints. Maximum oil temperatures 60°C. (140°F.) at ring main, 140°C. (284°F.) at central bearing scavenge. Oil specification MIL-0-6081a Grade 1010.

MOUNTING.—Four-point suspension with two trunnions on turbine nozzle box and two mounting-pads on centre casing. Alternatively, a three-point pick-up having two trunnions on centre casing and an adjustable strut on backbone casing may be used.

STARTING.—Jack & Heintz D26-3 electric starter in nose bullet. Two GLA high-intensity igniter plugs and two Avro torch igniters fed through solenoid-operated reducing valve from high-pressure fuel line.

DIMENSIONS.—
Nominal diameter 42 in. (107 cm.).
Overall length 121.46 in. (308 cm.).

NET DRY WEIGHT.—
2,685 lb. (1,219 kg.).

PERFORMANCE RATING.—
Static thrust over 6,000 lb. (2,720 kg.) at 7,800 r.p.m. at sea level..

ROLLS-ROYCE

ROLLS ROYCE OF CANADA, LTD.

HEAD OFFICE AND WORKS: COTE DE LIESSE ROAD, NEAR MONTREAL, P.Q.

General Manager and Chief Engineer: Dr. E. Warlow-Davies.

Production Manager: David Boyd.

Rolls-Royce of Canada, Ltd. was formed in 1952 to undertake the assembly and manufacture of Rolls-Royce gas-turbine engines. It is the successor to Rolls-Royce Montreal, Ltd. which operated solely as a service organisation for Rolls-Royce engines in use in Canada.

The new company has been awarded a contract by the Department of Defence Production for the supply of a large number of Nene turbojet engines for installation in the Silver Star (T-33A) two-seat jet trainer now in production for the R.C.A.F. by Canadair, Ltd. At the outset, engines will be assembled mainly from parts supplied by the parent company in Great Britain, but it is intended that ultimately the engines will be largely manufactured in Canada.

Rolls-Royce of Canada also holds Department of Defence Production contracts for the manufacture of Nene spare parts and for the overhaul of Nene engines.

The new company has built a factory, complete with engine test installations, on the Cote de Liesse Road, near Montreal. This factory was completed early in 1953.

FRANCE

HISPANO-SUIZA

SOCIÉTÉ D'EXPLOITATION DES MATÉRIALS HISPANO-SUIZA.

HEAD OFFICE AND WORKS: RUE DU CAPITAINE GUYNEMER, BOIS COLOMBES (SEINE).

The Hispano-Suiza company entered the turbojet field by acquiring the licence to build the Rolls-Royce Nene and Tay engines. More recently the company has acquired a licence for the Rolls-Royce Avon axial-flow engine.

The first production engine was the Nene for installation in the S.N.C.A.S.E. Mistral and the Dassault Ouragan. Over 800 Nenes have already been built.

The Tay has since gone into production and this engine will power the Dassault Mystère III and Mystère IV. It has also been fitted in several prototypes of the Mystère II. A Tay-engined Mystère II was the first French aircraft to exceed the speed of sound.

The Hispano Avon of RA.7 rating will be installed in the Mystère IV B, and a civil engine of RA.16 rating will be used in the Hurel-Dubois H.D. 45 and the Sud-Ouest S.O. 210 Caravelle, prototypes of which are under construction.

Hispano-Suiza has also undertaken considerable development work in both engines and afterburners and brief details of the Hispano-Suiza R-300, developed from the Nene, and the R-450, developed from the Tay, are given below.

THE HISPANO-SUIZA NENE.

The Hispano-Suiza Nene, built under Rolls-Royce licence, exists in two main production versions, the Nene 102 and 104.

The 102 is substantially identical to the Rolls-Royce Nene, whereas in the 104 considerable use is made of magnesium.

DIMENSIONS.—
Max. diameter 1.258 m. (49.5 in.).
Overall length 2.96 m. (116.5 in.).
Frontal area 1.24 m.² (13.3 sq. ft.).

WEIGHT (Nene 102).—
780 kg. (1,716 lb.).

WEIGHT (Nene 104).—
730 kg. (1,606 lb.).

PERFORMANCE.—
Max. take-off 2,360 kg. (5,200 lb.) s.t. at 12,300 r.p.m.
Max. continuous output 2,088 kg. (4,590 lb.) s.t. at 12,000 r.p.m.

THE HISPANO-SUIZA R-300.

The R-300 is an Hispano-Suiza development of the Nene. The principal modifications from the Nene involve the compressor and the system of cooling, the hollow turbine stator blades being cooled internally by air bled from the compressor.

Otherwise the R-300 uses some 90 per cent. of Nene parts and can be produced with existing tooling. It is interchangeable with the Nene in existing aircraft installations.

The R-300 is 2½ per cent. heavier than the Nene 102 and has a net static thrust rating of 2,700 kg. (5,940 lb.) at 12,500 r.p.m. The specific fuel consumption at maximum power is less than 1.09 kg./kg. thrust/hr. (1.09 lb./lb. thrust/hr.).

THE HISPANO SUIZA TAY.

The Tay, of basic Rolls-Royce design, is a development of the Nene in which internal changes have been made to allow the engine to consume about 30 per cent. more air and in consequence to produce more thrust. In all other respects it is generally similar to the Nene and is essentially interchangeable with that engine.

The Tay 250 is the first Hispano-Suiza production engine.

DIMENSIONS.—
Max. diameter 1.270 m. (50 in.).
Overall length 2.54 m. (100 in.).

WEIGHT DRY.—
920 kg. (2,025 lb.).

PERFORMANCE.—
Max. take-off 2,850 kg. (6,270 lb.) at 10,200 r.p.m.

THE HISPANO-SUIZA R-450 VERDON.

The R-450 Verdon is a development of the Tay 250, the principal modifications being generally similar to those employed to evolve the Tay from the Nene. These include internal changes to permit a greater flow of air through the engine; an increase in turbine speed; and a slight increase in the permissible gas temperature after the turbine. In other respects, the Verdon uses the greatest possible number of Tay components and is installationally interchangeable with the Tay.

For a dry weight of 915 kg. (2,015 lb.), the Verdon has a static thrust rating of 3,500 kg. (7,720 lb.) and a specific fuel consumption of 1.07 kg./kg. s.t./hr. (1.07 lb./lb. s.t./hr.).

The Verdon was first flown in a Dassault Mystère on August 3, 1953.

RATEAU

SOCIÉTÉ RATEAU.

HEAD OFFICE AND WORKS: RUE RATEAU, LA COURNEUVE (SEINE).

Director-General: M. René Anxionnaz.

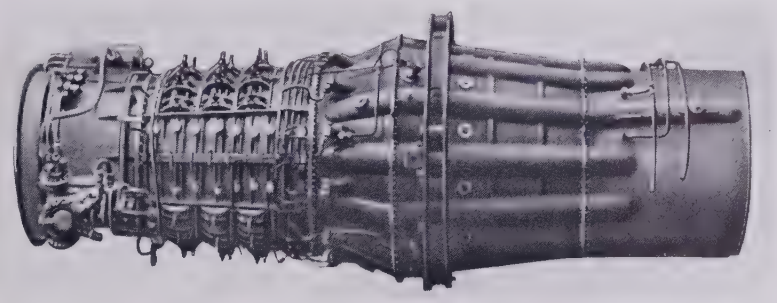
Deputy Director-General: Louis Hermitte.

Technical Director: Professeur Marcel Sedille.

The Société Rateau, well-known for its work with turbo-superchargers, began the development of turbo reaction motors in 1939. During the German occupation, clandestine work continued under considerable difficulties, small parties of engineers who were engaged in the project being compelled to work more or less independently in order to minimise the risk of detection.

After the liberation the results of their work was co-ordinated and with the assistance of the Air Ministry, work was immediately begun on the construction of the Rateau turbojet engine. This engine, the SRA-1 (Société Rateau-Anxionnaz), completed its acceptance tests successfully in February, 1947, at La Courneuve.

The Société Rateau has now under development the SRA-101, suitable for high-speed military aircraft, particulars of which are given below.



The Rateau SRA-101 Savoie turbojet engine.

THE RATEAU SRA-101 SAVOIE.

TYPE.—Axial-flow turbojet with ten stage compressor and two stage turbine.

COMPRESSOR.—Axial-flow ten-stage compressor rotor on common shaft with turbine the whole enclosed in single steel casing. Ten rotor discs each with one row of steel blades. One row of inlet guide vanes and ten rows of steel fixed blades on casing. Tubular shaft carrying rotating assembly runs on three ball bearings, two forward of compressor and one aft of turbine. Compression ratio 6.8. Mass air flow 53 kg. (117 lb.) per sec. at take-off r.p.m.

COMBUSTION CHAMBERS.—Twelve straight-through tubular stainless-steel combustion chambers each enclosing a perforated flame with fuel atomiser at front end.

FUEL SYSTEM.—Single manifold Rateau injection pump with automatic regulator. Maximum fuel supply pressure 15 kg./cm.² (215 lb./sq. in.).

FUEL.—Gasoline or Kerosene.

TURBINE.—Two-stage turbine. Alloy steel turbine wheels and blades. On common tubular shaft with compressor.

JET PIPE.—Adjustable inner cone enclosed in outer casing, both of stainless steel.

LUBRICATION.—Dry sump. Four-unit gear pump. Main bearings pressure fed. Normal oil supply pressure 4 kg./cm.² (57 lb./sq. in.).

STARTING.—Rotax direct-drive electric starter. Four igniter plugs and high tension coils.

DIMENSIONS.—
Diameter 1.120 m. (44 in.).
Length (less tail-pipe) 3.350 m. (137.5 in.).

WEIGHT.—
1,040 kg. (2,288 lb.).

PERFORMANCE RATING.—
Take-off (static) with water injection 4,000 kg. (8,800 lb.) at 9,500 r.p.m. at sea level.
Take-off (static) without water injection 3,300 kg. (7,300 lb.) at 9,500 r.p.m. at sea level.
Climbing thrust 2,900 kg. (6,400 lb.) at 9,250 r.p.m. at sea level.
Normal cruising thrust 2,300 kg. (5,070 lb.) at 8,800 r.p.m. at sea level.

CONSUMPTIONS.—
Fuel (normal without water injection) 0.85 kg./kg. thrust/hr. (0.85 lb./lb. thrust/hr.).
Oil 3.2 kg./hr. (7.04 lb./hr.).

S.F.E.C.M.A.S.

SOCIÉTÉ FRANÇAISE D'ETUDES ET DE CONSTRUCTIONS DE MATÉRIELS AERONAUTIQUES SPECIAUX (S.F.E.C.M.A.S.).

HEAD OFFICE: 12, RUE BÉRANGER, CHATILLON-SOUS-BAGNEUX (SEINE).

This new private concern results from the change of status from January 1, 1953, of the Arsenal de l'Aéronautique, which ceased to exist as a State-owned establishment on December 31, 1952. The activities of the new company remain practically the same as those of its predecessor.

Besides the production of the Ars. 12H piston engine which is described elsewhere, the S.F.E.C.M.A.S. is developing various types of ramjets, pulse-jets and rocket motors to be used either as primary power-units or as auxiliary motors for aircraft and missiles, subsonic as well as supersonic.

Among these types the Ars. Ø 600 and Ø 900 high subsonic ramjets may be quoted with the characteristics given below.

THE ARS. 600 RAMJET.

DIMENSIONS.—
Length 3,250 mm. (127.9 in.).
Diameter 600 mm. (23.6 in.).

WEIGHTS*.—
72 kg. (158.4 lb.).

PERFORMANCE.—
†Net thrust at S/L. at 1,000 km.h. (621 m.p.h.) 500 kg. (1,100 lb.).
†Net thrust at 12,000 m. (39,360 ft.) at 900 km.h. (560 m.p.h.) 120 kg. (264 lb.).

FUEL CONSUMPTION.
At sea level at 1,000 km.h. (621 m.p.h.) 0.88 kg./sec. (1.94 lb./sec.).
At 12,000 m. (39,360 ft.) at 900 km.h. (560 m.p.h.) 0.19 kg./sec. (0.42 lb./sec.).

THE ARS. 900 RAMJET.

DIMENSIONS.
Length 4,125 mm. (162.4 in.).
Diameter 900 mm. (35.4 in.).

WEIGHT*.
110 kg. (242 lb.).

PERFORMANCE.
†Net thrust at S/L. at 1,000 km.h. (621 m.p.h.) 1,140 kg. (2,510 lb.).
‡Net thrust at 12,000 m. (39,360 ft.) at 900 km.h. (560 m.p.h.) 285 kg. (627 lb.).

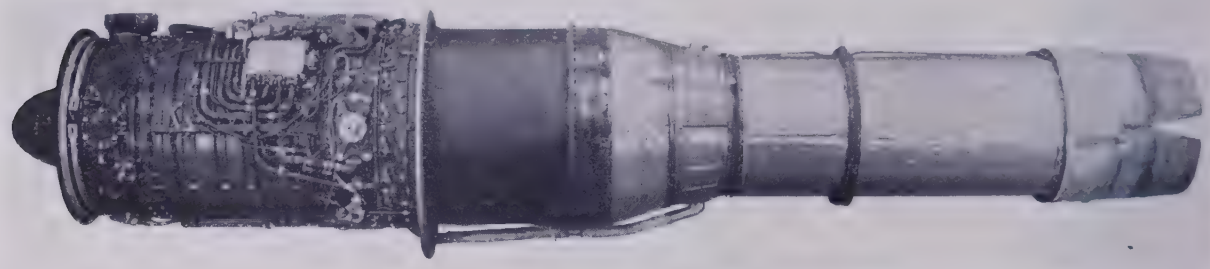


The S.F.E.C.M.A.S. Ars. 600 Ramjet.

FUEL CONSUMPTION.—
At sea level at 1,000 km.h. (621 m.p.h.) 2 kg./sec. (4.4 lb./sec.).
At 12,000 m. (39,360 ft.) at 900 km.h. (560 m.p.h.) 0.45 kg./sec. (0.99 lb./sec.).

*Weights given include diffuser, combustion chamber, flameholder, injection grid with fuel injectors, and ramjet nozzle.
‡Net thrust is the force transmitted to the attachment points.

SNECMA



The SNECMA Atar 101-C turbojet engine which has a thrust rating of 2,800 kg. (6,160 lb.).

SOCIÉTÉ NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION (SNECMA).

HEAD OFFICE : 150 BOULEVARD HAUSSMANN, PARIS (XIIIE).

WORKS : PARIS (BOULEVARD KELLERMANN), BILLANCOURT (SEINE), VILLAROCHE (SEINE-ET-MARNE), SURESNES (SEINE) AND GENNEVILLIERS (SEINE).

President and Director-General : Henri Desbruères.

Administrative Director : M. Du Chaxel.

Technical Director (Gas Turbine engines) : H. Oestrich.

Technical Director (Piston engines) : Raymond Marchal.

Director-Controller : Marcel Richer.

Director of External Relations : Gilbert Racine.

The Société Nationale d'Etude et de Construction de Moteurs d'Aviation (SNECMA) is actually devoting the major part of its activities to the development and series production of gas-turbine engines.

Several Atar-engined prototypes flew for the first time in the latter part of 1952 and early in 1953, including the Sud-Ouest S.O. 4050 Vautour, the Dassault M.D. 452 Mystère II, the Sud-Ouest S.O. 30P-Atar test-bed and a Gloster Meteor-Atar test-bed. The S.O. 4050 was the first aircraft to be designed specially to be powered with Atar 101 turbojets. A proportion of the M.D. 452 Mystère II fighters now in production for the French Air Force will be Atar-powered.

The latest SNECMA turbojet engine is the Vulcain, a large axial-flow engine which in initial tests have developed a static thrust of over 4,540 kg. (10,000 lb.). An illustration and brief details of this engine will be found below.

SNECMA continues its development in the field of pulsating jet units and brief details of the Escopette and Ecrevisse units are given hereafter.

THE SNECMA VULCAIN.

The Vulcain is an axial-flow turbojet engine of new design of which no details were available at the time of closing for press. The initial calculations for the design were begun on June 15, 1951, and the first prototype engine was ready to run on May 21, 1952.

The designed sea level static thrust of the Vulcain is 4,500 kg. (9,900 lb.) but it is now understood to be running at well over 4,540 kg. (10,000 lb.) s.t. dry and at over 5,450 kg. (12,000 lb.) with water injection. The weight of the engine is 1,400 kg. (3,080 lb.) and the overall diameter 1,160 mm. (45.6 in.).

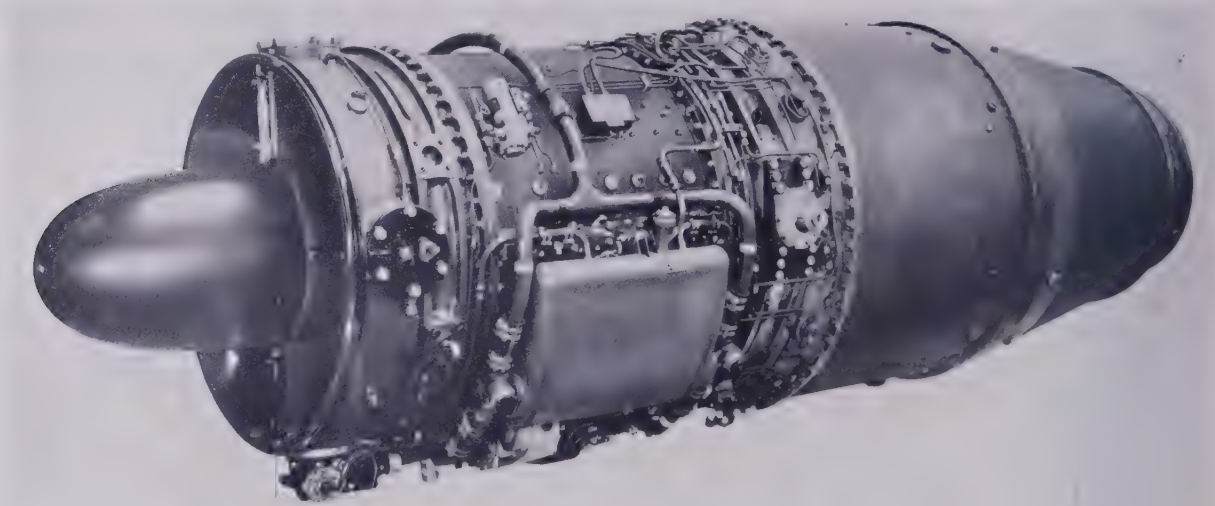
First flight testing of the Vulcain will be made in a Sud-Est S.E. 2010 Armagnac, while several prototypes to be powered by the Vulcain are already under construction.

THE SNECMA ATAR 101.

The development of the ATAR 101 axial-flow turbojet engine has been proceeding for several years. The prototype engine ran its first tests in 1948, and this was followed by the 101-B which completed its 150-hour homologation test at a static thrust of 2,200 kg. (4,850 lb.), later raised to 2,400 kg. (5,280 lb.).

The 101-C, which is now in series production, has a static thrust rating of 2,800 kg. (6,160 lb.), and this engine will be followed on the production lines by the 101-D which is rated at 3,000 kg. (6,600 lb.) static thrust.

In conjunction with the development of the engine proper, a number of improvements have been made to the afterburner designed for the Atar 101, and a 101-F, which is the 101-D with afterburner, develops a static take-off thrust of 3,800 kg. (8,360 lb.) with afterburning.



The SNECMA Vulcain axial-flow turbojet engine which has a thrust rating of 4,500 kg. (9,900 lb.).

Future developments include the 101-E (3,300 kg.=7,260 lb. s.t.) and the 101-G (4,000 kg.=8,800 lb. s.t.), which is the 101-E with afterburning.

The description which follows refers specially to the ATAR 101-D.

TYPE.—Axial-flow gas turbine with annular combustion chamber and single-stage turbine.

COMPRESSION.—Seven-stage compressor. Rotor drum built up from individual discs, the rotor blades having prismatic roots which slide into corresponding slots in the periphery of the discs. Stub shafts flanged on each end of drum run in ball (forward) and roller (aft) bearings. Two-piece light alloy casing with inserted light metal guide vanes. Between compressor and combustion chamber is an entry casing which, apart from the ring of burners and fuel injectors, contains the rear compressor bearing and the drives for accessories and oil pumps. Compression ratio 4.5 at 8,500 r.p.m.

COMBUSTION CHAMBER.—Sheet steel annular chamber with twenty single burners. Air from compressor is divided into primary and secondary air at the combustion ring, the primary air alone streaming through burners. The secondary air is ducted to enter the combustion chamber through the holes of the concentrically arranged inner annular liners. Fuel is injected downstream into primary air through ATAR 661 dual-flow injectors. Ten starting injectors and two igniter plugs.

FUEL SYSTEM.—ATAR 534 fuel pump unit consisting of centrifugal pump, filter and high-pressure gear type pump. ATAR 601 single-lever control regulating automatically r.p.m. and temperature.

FUEL SPECIFICATION.—Turbofuel Norme AIR 3405 (density 0.810).

NOZZLE GUIDE VANES.—An air-cooled sheet steel nozzle guide vane precede the turbine.

TURBINE.—Single-stage turbine with fifty-nine blades of chrome-nickel alloy. Turbine drives the compressor *via* a movable tooth coupling and a large hollow shaft.

JET PIPE.—Fixed outer casing with automatically-controlled inner cone movable axially, or automatically-controlled jet pipe of the "eyelid" type.

ACCESSORY DRIVES.—Drive on compressor entry casing for permanent output of 35 h.p. for driving airframe accessories.

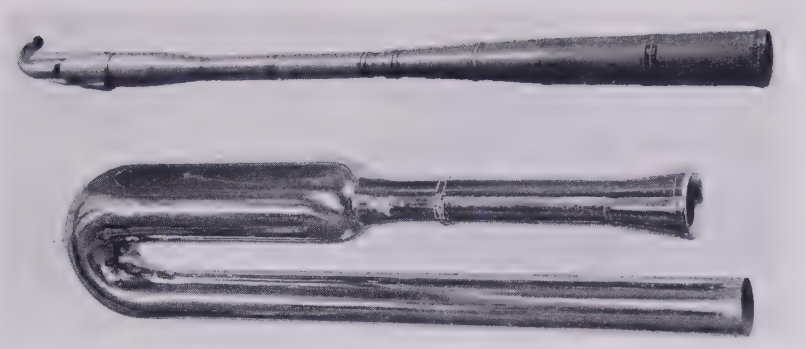
LUBRICATION.—Dry sump. One pressure pump and scavenge pumps. Centrifugal oil cleaner in oil return. Oil-fuel heat exchanger. Normal oil pressure 4 kg./cm.^{2} (57 lb./sq. in.).

STARTING.—Rotax electric starter.

DIMENSIONS.—
Length 3,580 mm. (141 in.).
Diameter 920 mm. (36.2 in.).
Frontal area 0.665 m.^{2} (7.15 sq. ft.).

WEIGHT DRY (including oil tank and heat exchanger).—
950 kg. (2,068 lb.).

PERFORMANCE RATINGS.—
Take-off and combat thrust (static) 3,000 kg. (6,600 lb.) at 8,500 r.p.m. at S/L.
Climb (static) 2,700 kg. (5,950 lb.) at 8,300 r.p.m.
Max. continuous (static) 2,400 kg. (5,300 lb.) at 8,100 r.p.m.



Two SNECMA pulse-jet units, the Escopette above and the Ecrevisse below.

CONSUMPTIONS.—
Fuel (cruise) 1.0 kg./kg. s.t./hr. (1.0 lb./lb. s.t./hr.).
Oil (cruise) 2.2 lb. (1.0 kg.) per hour.

SNECMA PULSE-JETS.

SNECMA has been engaged since 1950 in the development of pulse-jet units which are devoid of all moving parts.

The first pulse-jet was the Escopette (Carbine) which weighs 4.8 kg. (10.5 lb.) and develops a static thrust of 10 kg. (22 lb.). The unit is provided at its front end with a "recuperator," the function of which is to reverse the undesirable forward flow of gases at the time of explosion. The remainder of the unit, comprising the aerodynamic flow valve, the combustion chamber with burner and starting plug, body and jet-pipe, is an unobstructed tube of varying diameters, the gas movements being regulated by the dissymetrical aerodynamic form of the flow valve. The overall length of the Escopette is 2,800 mm. (113.25 in.). A development of the Escopette, known as the Tromblon (Blunderbuss), has given a greater thrust and lower specific fuel consumption.

The Escopette and Tromblon pulse-jets in combinations of four and six, have been flight-tested in Emouchet type sailplanes, over 400 flights having been made.

The latest development in SNECMA pulse-jets is the Ecrevisse (Crayfish). In this the "tube" itself is bent double through 180°, which makes it possible to dispense with the "recuperator" found on the Escopette. Air, induced to enter the flow valve through the aft facing inlet above, mixes with fuel fed through the single burner in the combustion space to form a self-igniting mixture, the hot gases passing out through the lower orifice. The internal depression caused by the inertia of the escaping gas draws in a fresh charge of air. The tube resonates at about 60 cycles per second.

The Ecrevisse Type A, which weighs 6 kg. (13.2 lb.) and has an overall length of 1,540 mm. (60 in.), develops a maximum thrust of 20 kg. (44 lb.), while the Type B which is 2,480 mm. (97.5 in.) long and weighs 10 kg. (22 lb.), attains a thrust of 30 kg. (66 lb.). The consumption of the Type B Ecrevisse is 1.35 kg./kg. s.t./hr. (1.35 lb./lb. s.t./hr.).

Research is proceeding in connection with various possible applications of pulse-jet units, some of which cannot be disclosed.

THE SNECMA THRUST SPOILER.

SNECMA has developed and successfully tested a device for the reversal, or partial reversal, of the jet stream of a gas-turbine engine to provide a means of braking comparable with that produced by a reversible-pitch airscrew on a piston or turboprop engine.

The device consists of a series of annular deflector vanes concentric with the thrust line and fitted at the exhaust end of the tail-pipe. To deflect the jet stream a high-pressure jet of air bled from the compressor is fed into the centre of the exhaust stream, forcing the main flow outward into the vanes and so turning the stream outward and forward to produce negative thrust equal to about half the rated positive thrust.

Following wind-tunnel tests, the device was fitted to a Goblin engine of a Vampire and first flight-tested in July, 1952. The landing run of the Vampire has been reduced by half with the thrust spoiler and normal use of wheel-brakes. The thrust spoiler has also been tested successfully on other types of engines, including the Turboméca Piméné and the SNECMA Atar 101-C.

Development work continues and is concerned mainly with the improvement of performance, the progressive application of counter thrust, and the application of the thrust spoiler to engines fitted with afterburning.

TURBOMÉCA

SOCIÉTÉ TURBOMÉCA.

HEAD OFFICE AND WORKS: BORDES (BASSES-PYRÉNÉES).

PARIS OFFICE: 56, RUE DU FAUBOURG ST.-HONORÉ.

President and Director General: J. R. Szydlowski.

The Société Turboméca was formed in 1938 by MM. Szydlowski and Planiol to develop blowers, compressors and turbine for aeronautical use.

In June, 1940, the company was instructed to move from Billancourt to Bordes in the Pyrenees, where it continued to work until the complete occupation of France. Its factory was pillaged by the enemy but after re-equipment after the Armistice work was resumed on the manufacture of compressors for Hispano-Suiza and Gnôme-Rhône engines, and on the development of cabin supercharging and air-conditioning compressors, centrifugal and axial-flow compressors for research and industrial uses, and gas-turbines.

In 1947 the company began the development of gas-turbines of low power for driving aircraft auxiliaries and for aircraft propulsion.

The company's first small turbojet engine was the Piméné, which first flew in the Fouga Cyclone powered-sailplane on July 14, 1949. The Piméné was the first French turbojet engine to pass the official homologation tests at Chalais Meudon under I.C.A.O. conditions.

The range of Turboméca gas-turbine engines includes the Palas (160 kg.=352 lb. s.t.) and Marboré II (400 kg.=880 lb. s.t.) turbojet engines; the Aspin II ducted-fan engine (330 kg.=725 lb. s.t.); the Orédon (158 s.h.p.) and Artouste (400 h.p. s.h.p.) shaft turbines; and the Pimédon, Palouste and Arins air compressors.

Both the Palas and Marboré turbojets power a number of aircraft and both engines are also being used as auxiliary power-units to increase the utility of existing twin-engined civil aircraft, such as the DC-3 and C-46. For the latter purpose the engines are suspended under the fuselage or wings and, operating directly off the main fuel system of the aircraft, are used to give added power for take-off and climb and are available as a source of reserve power when needed.

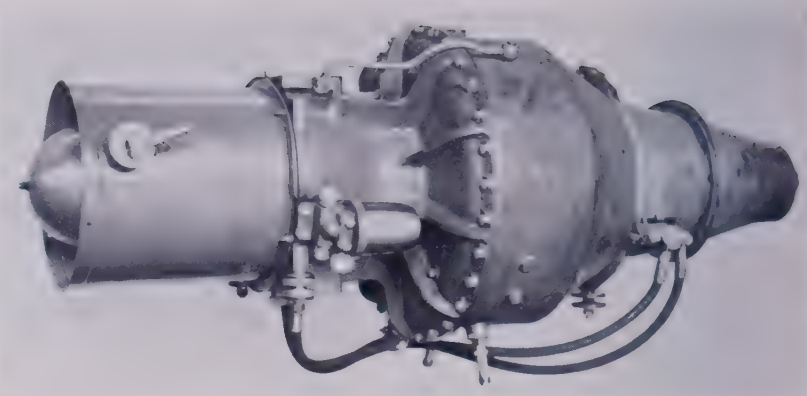
The shaft turbine engines are suitable for many applications where useful horse-power is required at a single mechanical coupling. The Artouste II engine is for example driving the tractor airscrew of the Sud-Ouest S.O. 1310 Farfadet gyroplane. Other applications include power for helicopters, military ground vehicles, small boats, etc.

The compressed air generators are also suitable for many applications, including helicopter power-drives, starting power for large gas-turbines, etc. The Arius is used to supply compressed air to the

rotor-tip combustion chambers in the S.O. 1120 Ariel III helicopter and S.O. 1310 Farfadet gyroplane, while the Palouste supplies propulsive air to the rotor-tip jets of the S.O. 1220 Djinn helicopter.

A remarkable degree of interchangeability exists among the whole range of Turboméca engines.

Licences for Turboméca gas-turbines have been negotiated with the Blackburn and General Aircraft, Ltd. in England, and the Continental Motors Corporation in the United States.



The Turboméca Palas light turbojet engine.

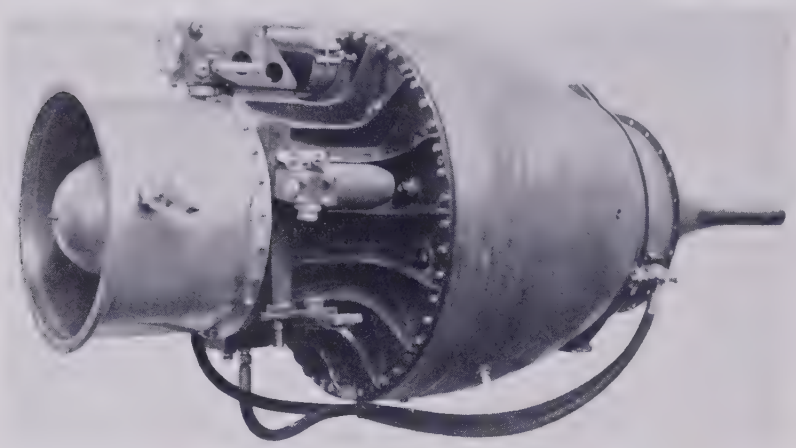
THE TURBOMÉCA PALAS.

TYPE.—Turbojet with single-stage compressor, annular combustion chamber with rotating fuel delivery ring and single-stage turbine.

COMPRESSION.—Single-stage centrifugal compressor. Compression ratio 3.8 : 1.

COMBUSTION CHAMBER.—Annular, with rotary fuel injection. The fuel ring, around the periphery of which are a number of vents, is attached to the shaft connecting compressor and turbine discs and revolves with it. Fuel is fed into the inside of the ring and is vented by centrifugal force, being vaporised in the process. Fuel delivery at low thrust settings regulated by by-pass valve.

TURBINE.—Single-stage single-piece turbine with 31 blades preceded by stator with twenty air-cooled vanes. Turbine r.p.m. 35,000. Gas temperature before turbine 700°C., after turbine 600°C.



The Turboméca Marboré II turbojet engine.

FUEL PUMP.—Martin-Moulet. Maximum pressure 4 kg./cm.² (57 lb./sq. in.)

FUEL.—Kerosene.

STARTER.—Air Equipement 24 volt electric or compressed-air starter. One igniter plug.

MOUNTING.—Three mounting pads, two on compressor casing and one on underside of combustion chamber.

DIMENSIONS.—
Diameter 40 cm. (16 in.).
Length 105.5 cm. (41.5 in.).

WEIGHT DRY.—
60 kg. (132 lb.).

PERFORMANCE RATING.—
Take-off (static) 160 kg. (352 lb.).

CONSUMPTION.—
Fuel 1.17 kg./kg. thrust/hr. (1.17 lb./lb. thrust/hr.).

THE TURBOMÉCA MARBORÉ II.

TYPE.—Turbojet with single-stage compressor, annular combustion chamber and single-stage turbine.

AIR INTAKE.—Annular sheet metal nose intake bolted to front of light alloy compressor casing.

COMPRESSOR.—Single-sided impeller machined from two alloy forgings, shrunk on steel shaft and locked and dowelled to maintain alignment. Externally-finned light alloy compressor casing supports front ball-bearing for rotating assembly in a central housing supported by three streamlined struts. This housing also contains gears for accessory drives. Compression ratio (at maximum r.p.m.) 3.9 : 1. Mass air flow 7.6 kg./sec. (16.75 lb./sec.).

COMBUSTION CHAMBER.—Composed of inner and outer sheet metal casings, forming annular flame tube. Air from compressor passes through both radial and axial diffuser vanes and divides into three main flows, two primary for combustion and one secondary. Two primary flows enter combustion zone from opposite ends of chamber, the rear stream through turbine nozzle guide vanes which it cools. Secondary flow enters through outer casing for dilution and cooling of combustion gases. Two torch igniters.

FUEL SYSTEM.—Fuel, pumped through hollow impeller shaft, is fed to combustion zone by rotating injector disc around periphery of which are number of vents which act as nozzles. Fuel is vented by centrifugal force, being atomised in the process. Fuel delivery at low thrust settings regulated by by-pass valve. Maximum fuel pressure approximately 175 kg./cm.² (2,500 lb./sq. in.).

FUEL GRADE.—Aviation Turbofuel (D.Eng. R.D. 2482 or JP-4).

NOZZLE GUIDE VANES.—Twenty-five hollow sheet steel guide vanes cooled by part of primary combustion air.

TURBINE.—Single-stage turbine with thirty-seven blades integral with steel disc. Bolted to main shaft and tail shaft, latter supported by rear roller bearing for rotating assembly.

JET PIPE.—Inner and outer sheet metal casings, latter supported by three hollow struts. Inner tapered casing extends beyond end of outer casing to induce air-flow through struts to cool rear main bearing and inner casing.

ACCESSORY DRIVES.—Gear casing in central compressor housing with drives for fuel and oil pumps. Connecting shaft to underside of accessories gear case above compressor casing. Accessories include tachometer generator and electric starter. Take-off (4 h.p. continuous) for remotely-driven accessory box.

LUBRICATION SYSTEM.—Pressure type. Single gear-type pumps serves front gear casing, two main bearings and r.p.m. governor. Three scavenge pumps return bearing oil to tank *via* cooler. Normal oil pressure 2.8 kg./cm.² (40 lb./sq. in.).

OIL SPECIFICATION.—D.Eng. R.D. 2479.

MOUNTING.—Four points, with Silentbloc rubber mountings, two at front and two at rear.

STARTING.—Air Equipement 24-volt electric starter or compressed-air starter. Two igniter plugs.

DIMENSIONS.—
Diameter 56.7 cm. (22.3 in.).
Length 133.3 cm. (52.4 in.).

WEIGHT (with electric starter).—
130 kg. (286 lb.).

PERFORMANCE RATING.—
Take-off (static) 400 kg. (880 lb.).
Max. continuous 320 kg. (704 lb.).

CONSUMPTIONS.—
Fuel (T.O.) 1.15 kg./kg. thrust/hr. (1.15 lb./lb. s.t./hr.).
Fuel (max. cont.) 1.07 kg./kg. thrust/hr. (1.07 lb./lb. s.t./hr.).

THE TURBOMÉCA ASPIN II.

TYPE.—Turbojet with ducted fan, single-stage compressor and two-stage turbine.

AIR INTAKE AND FAN.—Annular air entry containing one row of variable-incidence entry vanes, a single stage compressor fan and one row of fixed straightening vanes. Fan is driven by compressor shaft through coupling and reduction-gear. After fan the air stream is divided into primary and secondary flows, the former passing to the power section and the latter by-passing that section in an annular casing to the tailpipe where it mixes with the primary jet efflux.

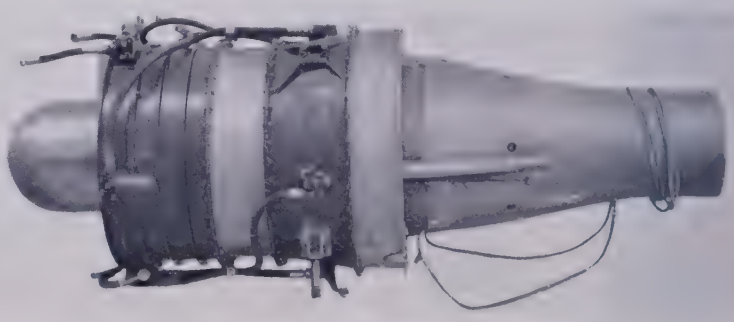
COMPRESSOR.—Single-stage centrifugal compressor. Single-sided impeller.

COMBUSTION CHAMBER.—Annular type, with rotary fuel injection as in Piméné.

TURBINE.—Two-stage axial-flow turbine.

JET PIPE.—Fixed inner cone, annular turbine nozzle and outer pipe wherein the jet efflux and by-passed secondary air mix.

CONTROL.—Single throttle lever determines the fuel flow and position of variable-



The Turboméca Aspen II "ducted-fan" turbojet engine.

incidence vanes. Engine speed controlled by centrifugal governor. For rapid manoeuvrability a push button operates an electro-hydraulic servo-motor which overrides manual control and at maximum rotational speed the throttle lever can be used solely to control the entry vanes to obtain rapid variations of thrust without having to overcome the inertia of the rotating assembly.

STARTING.—Throttle at "starter" setting only controls fuel delivery. Entry vanes are closed and engine speed governor is ineffective. Normal starter spins rotating assembly. When engine reaches a rotational speed of 70 per cent. of maximum governor and vane control become operative.

DIMENSIONS.—
Diameter 60 cm. (23.6 in.).
Length 121 cm. (47.5 in.).

WEIGHT (with electric starter).—
145 kg. (320 lb.).

PERFORMANCE RATINGS.—
Take-off (static) 360 kg. (792 lb.).
Max. continuous 300 kg. (660 lb.).

CONSUMPTIONS.—
Fuel (T.O.) 0.55 kg./kg. thrust/hr. (0.55 lb./lb. s.t./hr.).
Fuel (max. continuous) 0.52 kg./kg. thrust/hr. (0.52 lb./lb. s.t./hr.).

THE TURBOMÉCA ARIUS I.

The Arius I, which supplies compressed air to the rotor-tip combustion chambers of the Sud-Ouest S.O. 1120 Ariel III helicopter, has the following characteristics.

DIMENSIONS.—
Diameter 55 cm. (21.4 in.).
Overall length 80.5 cm. (31.4 in.).

WEIGHT (with accessories).—
84 kg. (185 lb.).

PERFORMANCE.—
Turbine shaft h.p. 280 at 36,000 r.p.m.
Air delivery (3.15 compression ratio) 1,260 gr./sec. (2.77 lb./sec.) at 34,000 r.p.m.
Air delivery (2.6 compression ratio) 1,210 gr./sec. (2.66 lb./sec.) at 32,000 r.p.m.

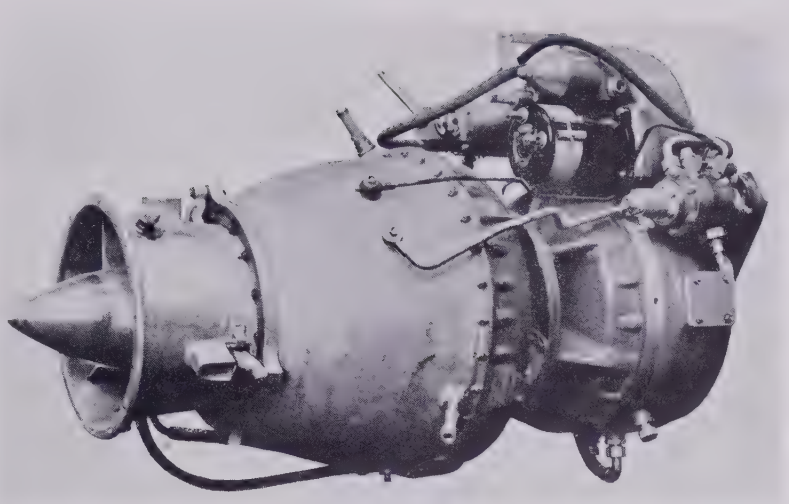
FUEL CONSUMPTION.—
400 gr./h.p./hr. (0.88 lb./h.p./hr.).

THE TURBOMÉCA ARIUS II.

This is a developed version of the Arius I. It has the following performance :—

PERFORMANCE.—
Air delivery (3.15 compression ratio) 1,800 gr./sec. (3.96 lb./sec.) at 34,000 r.p.m.
Air delivery (2.2 compression ratio) 1,580 gr./sec. (3.47 lb./sec.) at 32,000 r.p.m.

A new Arius II turbine is being developed. This will have a maximum shaft output of 400 h.p. at 34,500 r.p.m. and a maximum continuous output of 325 h.p.



The Turboméca Artouste gas-turbine engine.

THE TURBOMÉCA ARTOUSTE.

The Artouste gas-turbine delivers its power to a shaft and an engine of this type is used in the Sud-Ouest S.O. 1310 Farfadet gyroplane to drive a tractor airscrew.

TYPE.—Gas-turbine with centrifugal compressor, an annular combustion chamber and a two-stage turbine.

COMPRESSOR.—Single-stage centrifugal compressor. Compression ratio at 35,000 r.p.m. at S/L. 3.8 : 1.

COMBUSTION CHAMBER.—Annular type as in Palas.

TURBINE.—Two-stage axial type. 1st stage 20 stator blades and 25 rotor blades. 2nd stage 27 stator blades and 35 rotor blades.

JET PIPE.—Fixed type. Diameter of diffuser exit 275 mm. (10.8 in.). Exhaust gas speed 100 m./sec. (328 ft./sec.) maximum. Exhaust gas temperature 550°C. maximum.

DIMENSIONS.—
Length 0.930 m. (36.6 in.).
Height 0.590 m. (23.2 in.).
Width 0.510 m. (20.0 in.).

WEIGHT.—
98 kg. (215.6 lb.).

PERFORMANCE.—
Max. T.O. output 280 s.h.p. at 35,000 r.p.m. plus 21 kg. (46 lb.) residual thrust.
Max. continuous output 250 s.h.p. at 35,000 r.p.m. plus 18 kg. (40 lb.) residual thrust.
Cruising output 275 s.h.p. at 35,000 r.p.m. plus 15 kg. (33 lb.) residual thrust.

FUEL CONSUMPTIONS.—
At max. T.O. 127 kg. (254 lb.) per hour.
At max. continuous 118 kg. (260 lb.) per hour.
Cruising 110 kg. (242 lb.) per hour.

THE TURBOMÉCA PALOUSTE.

The Palouste is a turbo-generator which incorporates an oversize impeller in its compressor so that a proportion of the air may be taken from the engine after compression but before it enters the combustion chamber.

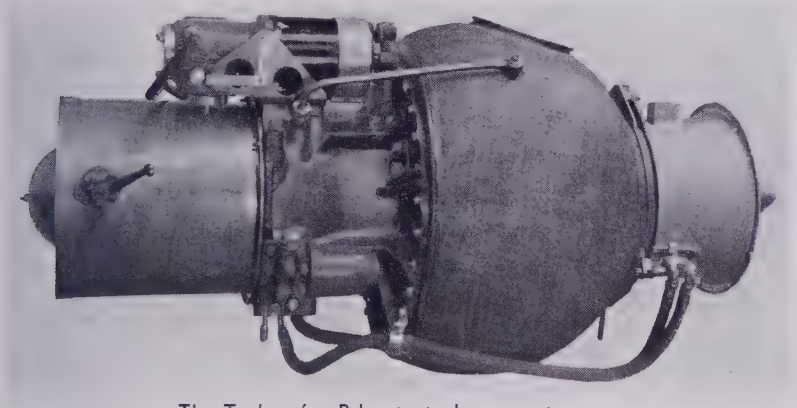
A Palouste turbo-generator is installed in the Sud-Ouest S.O. 1310 Farfadet gyroplane, where it supplies compressed air to the rotor-tip jets. This air is the rotor's sole means of propulsion.

The combustion chamber, turbine, accessory drives, etc. of the Palouste are similar to those of the Artouste.

DIMENSIONS.—
Length 1.059 m. (41.7 in.).
Height 0.500 m. (19.7 in.).
Width 0.475 m. (18.7 in.).

WEIGHT (with accessories).—
85 kg. (187.5 lb.).

PERFORMANCE (at ambient temperature of up to 45°C.). —
Air delivery (3.6 compression ratio) 860 gr./sec. (1.89 lb./sec.) at 35,000 r.p.m.
Air delivery (3.48 compression ratio) 760 gr./sec. (1.67 lb./sec.) at 34,000 r.p.m.



The Turboméca Palouste turbo-generator.

ITALY

FIAT

SOCIETA PER AZIONI FIAT—SEZIONE MOTORI AVIAZIONE.

OFFICE AND WORKS: VIA NIZZA 250, TURIN.

Director: Ing. Giovanni Perosino.

The Fiat Company was incorporated in 1899 and started on a bold policy which catered for all forms of locomotion. It began with motor vehicles and gradually extended its production to include tractors, heavy-oil engines, railway trucks, tanks, aircraft and aircraft engines, etc.

The vast, new and modern Mirafiori works in Turin were inaugurated in the Spring of 1939.

The first aero-engines were built in 1908; during the first World War the Fiat company contributed to the Allied victory with 15,000 aero-engines.

After the war 1914-18 the company pursued a very intensive research programme, especially on vee-type water-cooled engines. This was the period during which the Italian aircraft, fitted with these engines, accomplished intercontinental and trans-Atlantic record flights, won such international competitions as the Bleriot and Schneider Trophies, and broke the international Speed, Distance and Altitude records.

Since the last war Fiat has built no engines of its own design but it has entered the gas-turbine field by undertaking the licence-production of the de Havilland Ghost centrifugal-flow turbojet engine. It is also responsible for the maintenance and repair of the de Havilland Goblin engine, which is in service in the Italian Air Force.

Fiat has built a new factory for the manufacture of turbojet engines as well as a test establishment of the most up-to-date design.

In 1953 Fiat began manufacturing parts of the Allison J35 turbojet engine for the U.S.A.F.

THE FIAT GHOST 48 Mk. 1.

This is a Ghost 3 turbojet engine which is built under a de Havilland licence. Constructional details of the Ghost engine will be found under "de Havilland." The following particulars are those of the Ghost 48 Mk. 1 as built by Fiat.

DIMENSIONS.—
Diameter 134.6 cm. (53 in.).
Length 331.4 cm. (130.5 in.).
Frontal area 1.42 m.² (15.3 sq. ft.).

WEIGHT.—
962 kg. (2,120 lb.).

PERFORMANCE RATINGS.—
Take-off (static) 2,200 kg. (4,850 lb.) at 10,250 r.p.m. at sea level.
Normal (static) 1,883 kg. (4,150 lb.) at 9,750 r.p.m. at sea level.
Cruising (static) 1,460 kg. (3,220 lb.) at 9,000 r.p.m. at sea level.

CONSUMPTIONS.—
Fuel (cruising) 1.07 kg./kg. thrust/hr. (1.07 lb./lb. thrust/hr.).
Oil (max.) 1.7 litres per hr. (3 pints per hr.).

JAPAN

OMIYA FUJI

OMIYA FUJI KOGYO KABUSHIKI KAISHA (Omiya Fuji Industrial Co., Ltd.).

HEAD OFFICE: 1, KANONOMIYA, OMIYA, SAITAMA PROVINCE.

This company is one of four post-war subsidiary organisations of the former Nakajima Aircraft Manufacturing Company which was one of the largest suppliers of aircraft and aero-engines to the Japanese Navy and Army before and during the last war.

It is now engaged in gas turbine development. A prototype axial-flow turbojet engine, the JO 1, is nearing completion. For the development of this engine Omiya Fuji Kogyo K.K. was granted a Government subsidy of Y 3,500,000.

THE OMIYA FUJI MODEL JO 1.

TYPE.—Axial-flow Turbojet.

AIR INLET.—Annular nose air inlet surrounding nose bullet.

COMPRESSOR.—Eight-stage axial-flow. First and eighth blade discs of stainless steel, the remainder are aluminium-alloy forgings. Compression ratio about 4 : 1.

COMBUSTION CHAMBERS.—Eight straight-through chambers of stainless steel each with a concentrically-mounted perforated stainless steel flame tube with duplex-type fuel injection nozzle in the front end and discharging downstream. Chambers are interconnected to permit flame-spread during starting.

FUEL SYSTEM.—Single fuel-manifold system. Fuel pressure at maximum power 50 kg./cm.² (710 lb./sq. in.).

NOZZLE GUIDE VANES.—Forged steel ring with forty inserted and welded Nimonic 80A nozzle guide vanes.

TURBINE.—Single-stage axial flow, with sixty solid blades inserted in periphery of alloy-steel disc. Gas temperatures (at 12,000 r.p.m.) before turbine 800°C., after turbine 630°C.

JET PIPE.—Outer casing of stainless steel. Fixed inner cone.

LUBRICATION.—Wet sump. Main gear-type pump supplies oil to five main bearings. Auxiliary pump scavenges sump under turbine roller bearings and returns it to main pumps.

STARTING.—Direct-drive electric. Two torch igniters.

DIMENSIONS.—
Length 2,850 mm. (112 in.).
Diameter 680 mm. (26.7 in.).
Frontal area 0.33 m.² (3.56 sq. ft.).

WEIGHT DRY.—
450 kg. (990 lb.).

PERFORMANCE RATINGS.—
Max. static thrust 1,000 kg. (2,200 lb.) at 12,000 r.p.m.
Max. thrust at 800 km.h. (500 m.p.h.) at 9,000 m. (29,520 ft.) 400 kg. (880 lb.).

FUEL CONSUMPTION.—
1.11 kg./kg. s.t./hr. (1.11 lb./lb. s.t./hr.).

SOVIET UNION

(Union of Socialist Soviet Republics)

Very little reliable information is available about the development of jet power units in the U.S.S.R. The whole of the work is shrouded in great secrecy and is carried on by a number of Russian groups as well as by German workers. Russian workers in this field include Chelomei and Charomskii and the rocket expert Kostikov, all of whom have been mentioned as responsible for development of Russian and German power-plants after the War. Many Russian scientists are known to have worked on rocket propulsion for a number of years. In the period 1945-1947 there was extensive testing of small rocket units and athodyds on Russian flying test-beds, but little has become known about this development in more recent years.

Work on gas-turbine engines in the U.S.S.R. has proceeded along two main lines—the improvement of German axial-flow units and the development and production of British centrifugal-flow gas turbines.

Large amounts of materials and data and many workers were obtained from Germany. This enabled the Russians to produce series of BMW 003A and Jumo 004B units of relatively low power, which were used to propel the early Russian jet fighters such as the MIG-9 and YaK-15.

Apart from the BMW and Junkers material, the Walther and Argus factories were also occupied by the Russians. Many important German technicians and engineers are now engaged on design and production work for the Soviet Air Fleet and most of them are said to be located at an experimental centre at Kuibyshev. The names of many are known, but the exact projects on which they work are uncertain.

Unconfirmed reports say that further work on German engines has led to production of Russian versions of the BMW 003E and Jumo 004H and, later, of the Jumo 012 and the BMW 018 and the latter's turboprop development, the M-028.

Russia received thirty Rolls-Royce Derwent 5 and twenty-five Nene 1 engines from the United Kingdom in 1947-48. These engines were exported to Russia at the insistence of the then President of the Board of Trade, Sir Stafford Cripps, who overruled the objections of the Air Ministry and Rolls-Royce, on the grounds that the engines were free from all security restrictions and available for export, and that there was no embargo on export of such material to Russia.

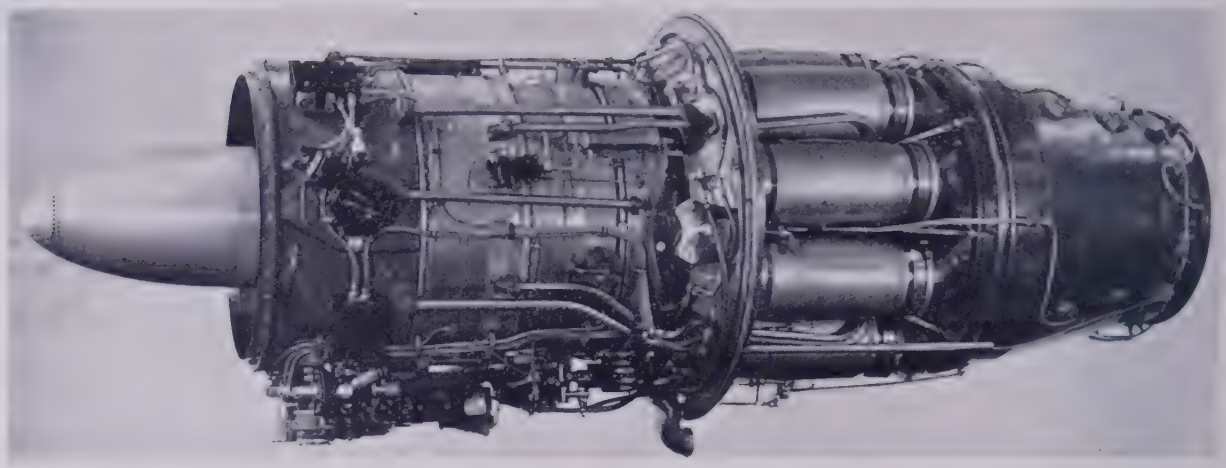
The Nene engine found considerable favour with the Russians and one of the batch of British-built Nenes was chosen to power the prototype MIG-15 in 1947. The MIG-15 airframe, which had not been designed for this engine, was specially modified to suit this eminently suitable power-plant which had unexpectedly and fortuitously arrived from the West.

The Nene was immediately prepared for production under the designation RD-45 and it is now said to have passed through two if not three main stages of development. The latest version shows a line of improvement similar to that along which the Tay has been developed from the Nene by both Rolls-Royce and Pratt & Whitney. Without increasing the overall diameter the engine has been redesigned internally to permit about 30 per cent. more air to pass through the engine, and to enable it to develop a static thrust of 6,000 lb. (2,625 kg.) for an engine weight of 2,000 lb. (900 kg.), as compared with 5,000 lb. (2,270 kg.) s.t. and 1,715 lb. (780 kg.) weight of the original Nene. The latest RD-45 also employs water injection, but there is no confirmation that an afterburner has been added although the enlarged tailpipe is said to be suitable for such an installation.

Captured examples of the RD-45 have been examined in both the U.S.A. and the United Kingdom, but at the time of writing no detailed information or data have been made available for publication. The workmanship of the captured engines is said to be of a very high standard.

SWEDEN

STAL



The STAL Dovern axial-flow turbojet engine which has a static thrust rating of 3,300 kg. (7,260 lb.).

SVENSKA TURBINFABRIKS AB LJUNGSTRÖM (STAL).

HEAD OFFICE AND WORKS: FINSPANG.

The Svenska Turbinfabriks AB Ljungström, which originally formed part of the AB Ljungströms Angturbin (Ljungströms Steam Turbine, Ltd.) began the development of aircraft gas-turbines immediately after the war. A prototype engine named the Skuten (Witch) was exhibited at the Heat and Power Exhibition which was held in Stockholm in October, 1949.

The Skuten had eight axial-flow compressor stages, seven straight-through combustion chambers and a single-stage turbine. The static thrust was 1,450 kg. (3,200 lb.) and the weight of the engine was about 780 kg. (1,720 lb.). No other details of this engine have ever been released for publication.

A new and higher-powered axial-flow turbojet engine, known as the Dovern, has been designed and built and the prototype engine has been test flown in a converted Avro Lancaster.

THE STAL DOVERN II.

The Dovern II axial-flow turbojet engine exists in the following forms:—

Dovern IIA. Basic engine without de-icing. Net dry weight 1,195 kg. (2,629 lb.).

Dovern IIB. The IIA with de-icing equipment. Net dry weight 1,220 kg. (2,684 lb.).

Dovern IIC. The IIB with an afterburner which increases the static sea level thrust by 30 per cent.

The description below refers to the IIB.

TYPE.—Axial-flow turbojet.

AIR INTAKE.—Annular magnesium-alloy nose intake with inner ring supporting front thrust bearing, power take-off and starter, with one row of inlet guide-vanes. Hollow struts, hollow inlet guide-vanes and nose bullet heated with hot air tapped from last compressor stage.

COMPRESSOR.—Nine-stage axial flow. Steel stator and rotor blades, the latter with dovetail secured in peripheries of nine discs and locked against axial movement. Discs are welded together at outer rims and second and eighth discs are welded to stub shaft. Shaft carried on ball thrust bearing forward and roller bearing aft. Compression ratio 5.2 : 1. Mass air flow 55 kg./sec. (121 lb./sec.).

COMBUSTION CHAMBERS.—Nine interconnected tubular combustion chambers of straight-through flow type. Steel outer casings, Nimonic 75 concentrically-mounted flame tubes. Lucas duplex burners injecting downstream. Lodge igniter plugs in primary zone in two combustion chambers.

FUEL SYSTEM.—Single manifold type. Two Lucas GC-200 multi-plunger variable-stroke pumps. Lucas SCH 2062 full range flow control with electrically-actuated high-pressure shut-off valve. Lucas SCH 2189 air-fuel ratio control. Lucas SCH 1735 flow distributor. Low-pressure filter. Max. fuel pressure 1,300 lb./sq. in.

FUEL GRADE.—Aviation turbofuel (D.Eng. R.D. 2482).

NOZZLE GUIDE VANES.—70 solid vanes of N. 155 alloy.

TURBINE.—Single stage axial-flow. Jessop H 46 alloy disc fixed to stub shaft by sixteen conical bolts. Ninety-seven blades of Nimonic 80A secured in periphery of disc by fir-tree roots. Gas temperature (at take-off) 870°C. before turbine, 675°C. after turbine.

JET PIPE.—Fixed type of stainless steel. Afterburner in Dovern IIC.

ACCESSORY DRIVES.—On left hand side there is a 70 h.p. power take-off for remote airframe-mounted accessory gear-box.

LUBRICATION SYSTEM.—Dry sump system. Gear type pressure and scavenge pumps. 3-unit plunger type metering pump for main bearings. Tecalemit oil filter. Integral oil tank of 7 litres (1.5 Imp. gallons) capacity. Normal oil supply pressure 2.5—3.0 kg./cm.² (.35—.43 lb./sq. in.).

OIL SPECIFICATION.—D.E.D. 2480.

MOUNTING.—Two mounting pads located near C.G. and free to move in a radial direction. A circular sliding ring on the compressor air intake is free to move in an axial direction.

STARTER.—Rotax Exp. 4278 112-volt D.C. electric starter or B.T.H. 5-A1 two-shot cartridge starter mounted in nose bullet.

DIMENSIONS.—
Diameter 1.095 mm. (43 in.).
Length 3,850 mm. (151.5 in.).
Frontal area 0.94 m.² (10.1 sq. ft.).

WEIGHT DRY.—
1,220 kg. (2,684 lb.).

PERFORMANCE RATINGS (Dry).—
Take-off (static) 3,300 kg. (7,260 lb.) at 7,200 r.p.m. at S/L.
Continuous (static) 2,600 kg. (5,720 lb.) at 6,800 r.p.m. at S/L.

CONSUMPTIONS.—
Fuel (normal) 0.92 kg./kg. s.t./hr. (0.92 lb./lb. s.t./hr.).
Oil (normal) 0.6 kg./hr. (1.32 lb./hr.).

SVENSKA

SVENSKA FLYGMOTOR AB.

HEAD OFFICE AND WORKS: TROLLHÄTTAN.

Svenska Flygmotor AB. has acquired a licence to build the Rolls-Royce RA7 axial-flow turbojet engine. The Avon powers the Saab-32 Lansen two-seat swept-wing all-weather fighter which has been ordered into production for the Swedish Air Force.

Svenska also holds a licence from the de Havilland Engine Co., Ltd. to build the Goblin 3 and Ghost 45 engines which power the D.H. Vampire and Saab-29 fighters which are now in service in the Swedish Air Force.

UNITED STATES OF AMERICA

AEROJET

AEROJET-GENERAL CORPORATION (Subsidiary of The General Tire & Rubber Company).

HEAD OFFICE AND WORKS: AZUSA, CALIFORNIA.

BRANCH PRODUCTION WORKS: SACRAMENTO, CAL.

President: William O'Neil.

Executive Vice-President and Managing Director: A. H. Rude.

General Manager: W. E. Zisch.

Research Consultant: Dr. F. Zwicky.

Secretary-Treasurer: T. E. Beehan.

The Aerojet-General Corporation is the largest manufacturer of rocket engines in the World and is outstanding in its field in the research and development of both liquid and solid propellant rocket engines and rocket propellants. The company originated the solid propellant JATO (jet assisted take-off) motor used by the Armed Forces of the United States during the last war.

Over 250,000 standard JATO units have been supplied to the U.S.A.F. and U.S. Navy during the past ten years.

Aerojet is presently devoting a considerable part of its effort to the development and manufacture of liquid and solid propellant jet assisted take-off rocket motors, liquid propellant guided missile power plants, and underwater rocket devices. It is the largest producer of solid propellant guided missile boosters in the United States.

THE AEROJET MODEL 15KS-1000 ROCKET.

The latest Aerojet JATO rocket is the "smokeless" 15KS-1000 (1,000 lb. of thrust for 15 seconds) which is now in full production, with first deliveries having been made to the U.S.A.F. and U.S. Navy for operational tests.

Prior to the development of the 15KS-1000 unit, the use of JATO was accompanied by a large stream of smoke which trailed behind the aircraft when the unit is fired. In cases where the smoke did not dissipate, due to lack of wind, further operations were often affected owing to the smoke screen created by the first few take-offs. The new smokeless unit gives an extra second of 1,000 lb. thrust with a 25% reduction in weight. The 15KS-1000 unit, which weighs 143 lb. (65 kg.), can be installed on the old type fittings without modification.

THE AEROJET MODEL 14AS-1000 Mk. 2 MOD. 3 ROCKET.

TYPE.—Single-chamber type JATO (jet-assisted take-off) rocket motor.

PROPELLANT.—Solid type (ALT-161). Propellant comprising solid fuel and oxidizer moulded into a cartridge secured within the cylindrical chamber. Auto-ignition temperature of propellent in excess of 700°F. (370°C.).

IGNITION.—By electrically-fired black powder igniter requiring 12 volts 25 amps for 0.110 seconds or 24 volts 50 amps for 0.32 seconds using 25 ft. (7.6 m.) for No. 20 copper wire.

INSTALLATION.—Three-position attachment, depending upon the installation on the aircraft. After firing unit may be jettisoned.

STORAGE AND OPERATING LIMITATIONS.—Motors can be fired in any position. Operating and storage temperature range is normally from 0°F. (—17.8°C.) to +130°F. (54.4°C.). Refer to detailed manual of instruction for temperature deviations. Units must be stored vertically, nozzle end up. Storage life—up to two years. After firing, the units may be returned to the manufacturer for reloading.

DIMENSIONS.—
Diameter 10.25 in. (261 mm.).
Overall length 35.4 in. (899 mm.).
Frontal area 0.57 sq. ft. (0.05 m.²).

WEIGHTS.—
Weight empty 120 lb. (54 kg.).
Weight loaded 200 lb. (91 kg.).

PERFORMANCE.—
Rated thrust 1,000 lb. (455 kg.).
Rated duration 14 seconds.
Total impulse 14,000 lb./sec. (6.360 kg./sec.).
Specific impulse 175 lb. sec./lb. (79 kg. sec./kg.).
Jet velocity 5,635 ft./sec. (1,717 m./sec.).

NOTE.—This rocket motor has been awarded United States Civil Aeronautics Administration approved Engine Type Certificate No. 249.

THE AEROJET MODEL 12AS-250B JUNIOR ROCKET.

TYPE.—Single-chamber type JATO rocket motor.

PROPELLANT.—Solid type with fuel and oxidizer moulded into a cartridge secured within the cylindrical chamber. Propellant is inert to shock and has an autoignition temperature in excess of 700°F. (370°C.).

IGNITION.—By a squib-initiated igniter which is incorporated in the inside end of the nozzle. The igniter main charge is black powder which is ignited by means of a small electric squib.

INSTALLATION.—Three-point suspension, depending upon the installation on the aircraft.

STORAGE AND OPERATING LIMITATIONS.—Operating and storage temperature range is normally from—40°F. (40°C.) to+150°F. (65.6°C.). The unit may be returned to the manufacturer for reloading and servicing.

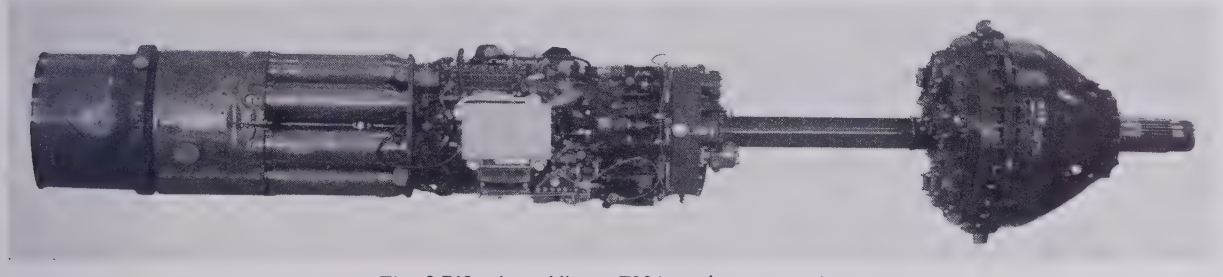
DIMENSIONS.—
Diameter 7 in. (17.8 cm.).
Overall length 14 in. (35.5 cm.).

WEIGHTS.—
Weight empty 35 lb. (16 kg.).
Weight loaded 55 lb. (25 kg.).

PERFORMANCE.—
Rated thrust 250 lb. (113.5 kg.).
Rated duration 12 sec.
Specific impulse 170 lb. sec./lb. (77 kg. sec./kg.).
Jet velocity 5,474 ft./sec. (1,668 m./sec.).

NOTE.—The United States Civil Aeronautics Administration has awarded Engine Type Certificate No. 250 to this rocket motor and has also approvod attachment brackets for this unit for installation on such aircraft as the Ryan Navion, Republic Seabee, Beech Bonanza and D18S, Ercoupe, Cessna, Luscombe and Stinson.

ALLISON



The 2,763 s.h.p. Allison T38A turboprop engine.

THE ALLISON DIVISION, GENERAL MOTORS CORPORATION.

HEAD OFFICE AND WORKS: INDIANAPOLIS 6, IND.

General Manager E. B. Newill.

Assistant General Manager: Harold H. Dice.

Director of Aircraft Engineering: R. M. Hazen.

Director of Manufacturing: W. G. Guthrie.

Manufacturing Manager: J. C. Cunningham.

The Allison Division of General Motors abandoned the manufacture of liquid-cooled reciprocating engines at the close of 1947 and it is now concentrating solely on the production of gas-turbines.

Since November, 1945, the Allison Division has held complete responsibility for the production and development of the J33 centrifugal-flow gas turbine, and since September, 1946, the same responsibility for the J35 axial-flow engine.

Allison also has a turboprop engine (T38) of its own design which has developed 2,760 h.p. under test. Two T38 engines driving a common gear-box and contra-rotating airscrews make up the T40 power-unit.

THE ALLISON T38A.

The T38 is an axial-flow turboprop engine which has been developed for the U.S. Navy. Two T38A engines have been installed in a Convair-Liner which has been acquired by Allison for extensive flight-testing of the new engine.

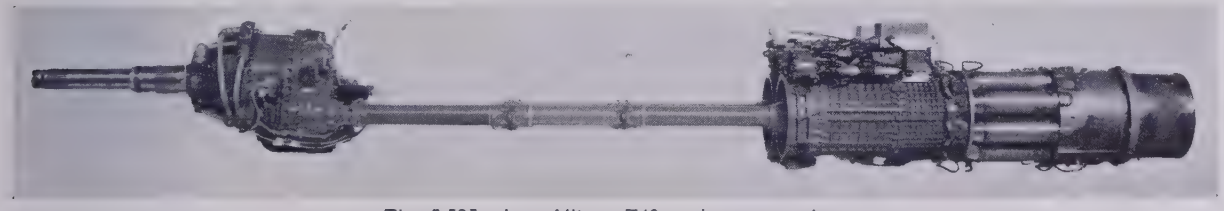
TYPE.—Axial-flow Turboprop.

COMPRESSOR.—Nineteen-stage axial-flow compressor. Compression ratio 6.3 : 1.

COMBUSTION CHAMBERS.—Eight interconnected stainless-steel straight-through chambers.

TURBINE.—Four-stage axial-flow turbine.

FUEL SYSTEM.—Pesco fuel pumps. Bendix fuel control and Allison automatic control.



The 5,525 s.h.p. Allison T40 turboprop engine.

DIMENSIONS.—
Overall length 147 in. (3,734 mm.).
Width 27 in. (66 mm.).
WEIGHT DRY.—
1,485 lb. (674 kg.).
PERFORMANCE.—
2,763 h.p. at 14,300 r.p.m.

THE ALLISON T40.

The T40, which has been developed for the U.S. Navy, consists of two XT38 axial-flow power sections driving an Aeroproducts six-blade co-axial contra-rotating airscrew through a common reduction gear. The power sections are connected together so that in effect they form a single unit and are connected to the reduction gear by extension shafts. Each power section can operate the contra-rotating airscrews independently or together.

The T40 engine powers the Douglas A2D-1 Skyshark, the North American XA2J-1, and the Convair XP5Y-1 flying-boat.

DIMENSIONS.—
Overall length 185 in. (4,700 mm.).
Width 40 in. (1,016 mm.).
WEIGHT DRY.—
2,575 lb. (1,169 kg.).
PERFORMANCE.—
5,525 h.p. at 14,300 r.p.m.

THE ALLISON J33 SERIES.

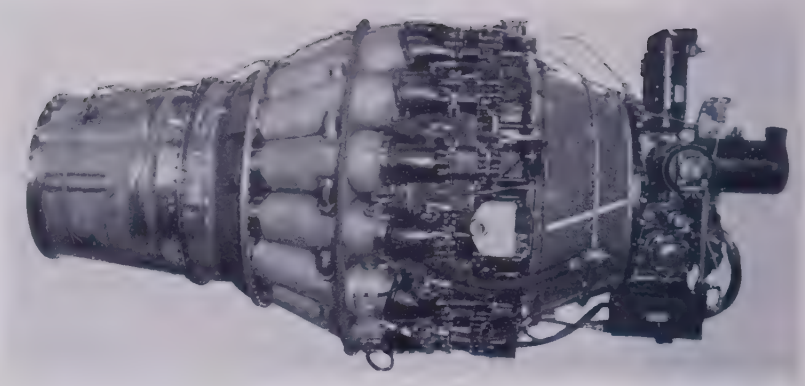
The latest models in the J33 Series of which details are available are :—

J33-A-10A. Serves as the third (jet) engine in the North American AJ Savage.

J33-A-16 and -16A. Powers the Grumman F9F-4 and F9F-7.

J33-A-35. Powers the Lockheed T-33 and TV-2.

TYPE.—Centrifugal-flow turbojet.
AIR INTAKE.—Circular air inlet with annular duct leading to impeller eye of compressor.
COMPRESSOR.—Single-stage double-entry centrifugal-flow, with double-sided impeller having on each side seventeen vanes. Diffuser has fourteen tangential outlets and terminal elbows leading to combustion chambers. Impeller assembly runs on one ball and one roller bearing, the shaft being coupled through flexible spline to turbine shaft. Compression ratio 4.4 : 1. Mass air flow 87 lb. (39 kg.) per sec. at sea level static thrust rating.
COMBUSTION CHAMBERS.—Fourteen straight-through combustion chambers with internal concentrically-mounted perforated flame tubes, each containing at its front end a fuel atomiser. Chambers are interconnected to permit flame spread during starting cycle. Igniter plugs in two chambers.
FUEL SYSTEM.—Double manifold type. Pesco dual injection pump delivers fuel to burners through Bendix main or Allison emergency flow control units. Provision for water/alcohol injection in J33-A-35.
FUEL GRADE.—Gasoline (100/130 Grade) or JP-3 (MIL-F-5624).
NOZZLE GUIDE VANES.—Forty-eight cast steel nozzle guide vanes inserted in periphery of steel diaphragm.
TURBINE.—Single-stage axial-flow comprising fifty-four solid alloy steel blades inserted in stainless-steel rotor disc, shaft of which runs on one ball and one roller bearing. Maximum allowable temperature after turbine 1,320°F.
JET PIPE.—Stainless steel jet pipe with fixed inner cone. Jet pipe and afterburner shrouded with insulating blanket.
AUXILIARY DRIVE.—Engine accessories, including fuel and oil pumps mounted on wheelcase at front of engine.
LUBRICATION SYSTEM.—Wet sump. Gear pump supplies pressure oil to main bearings. Normal oil supply pressure 38 lb./sq. in. (2.67 kg./cm.²). Integral oil tank.
STARTING.—Direct-drive electric starter to spin rotating assembly. Igniter plugs in two combustion chambers energised by two Scintilla transformers. Shielded.
DIMENSIONS (J33-A-16).—
Diameter 49.3 in. (1,252 mm.).
Overall length 99 in. (2,515 mm.).
DIMENSIONS (J33-A-35).—
Diameter 49.3 in. (1,252 mm.).
Overall length 106 in. (2,692 mm.).



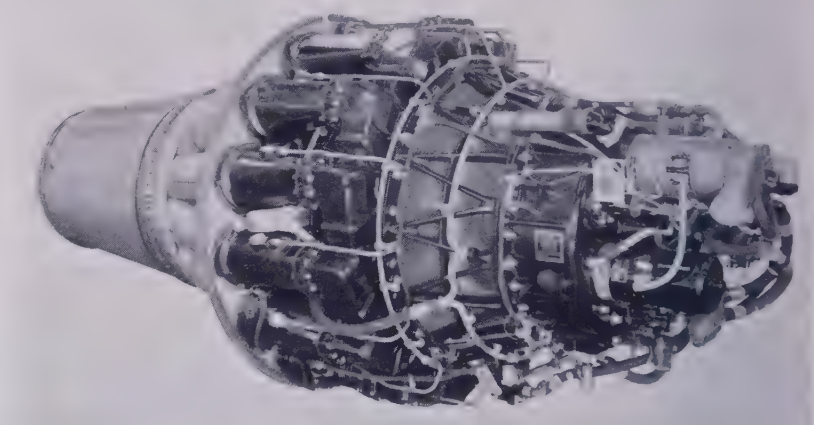
The Allison J33-A-16 centrifugal-flow turbojet engine.

J35-A-29. Has re-designed compressor to allow greater flow of air and higher compression ratio, and a new integral oil system. Static thrust rating 5,600 lb. (2,542 kg.). Powers the Republic F-84G.

J35-A-33 and -35. Similar to -29 but have afterburners and thermal anti-icing systems with retractable inlet screens, etc.

The description and specification below refers to the J35-A-33.

TYPE.—Axial-flow turbojet.
AIR INTAKE.—Circular intake with annular duct leading to first stage of compressor *via* entry guide vanes.



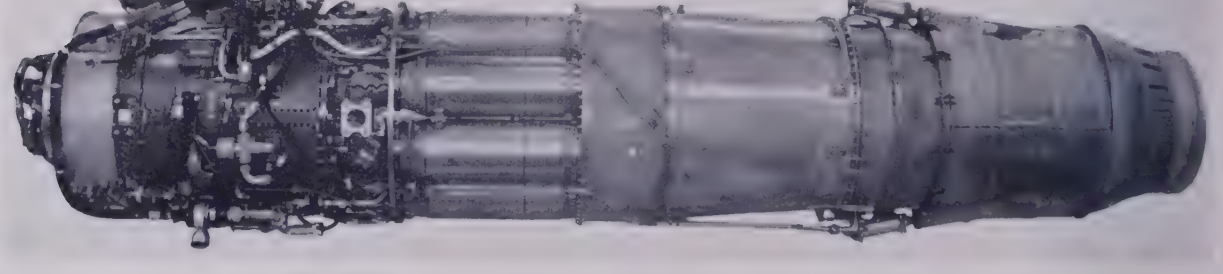
The Allison J33-A-35 centrifugal-flow turbojet engine.

PERFORMANCE RATINGS (J33-A-35).—
Static thrust rating 4,600 lb. (2,090 kg.) at 11,750 r.p.m.
Static thrust with water/alcohol injection 5,400 lb. (2,450 kg.) at 11,750 r.p.m.
Normal rated thrust 3,900 lb. (1,770 kg.) at 11,250 r.p.m.
CONSUMPTIONS (J33-A-35).—
Specific fuel consumption 1.14 lb./lb. thrust/hr. (1.14 kg./kg. thrust/hr.).
Take-off consumptions with water/alcohol injection 32.5 ± 1.5 U.S. gallons (222.8 ± 5.6 litres) per hour.

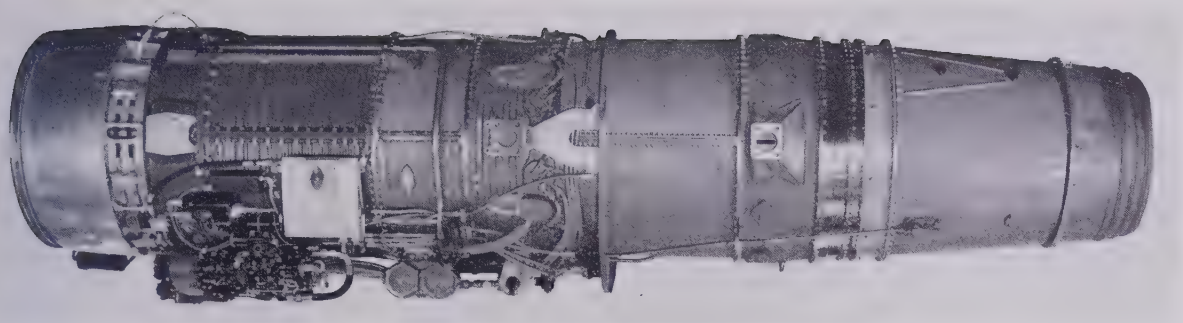
THE ALLISON J35 SERIES.

The latest engines in the J-35 Series of which details are available are as follows :—

COMPRESSOR.—Axial flow having eleven stages. Rotor built up of eleven discs, ten aluminium-alloy and one steel, each disc carrying one row of steel blades. Steel shaft, on to which discs are shrunk, rotates on one roller and one ball (thrust) bearings. Casing of magnesium-alloy in two sections bolted together, carries eleven rows of stator blades, plus one row of entry guide vanes forward and one row of straightening vanes aft. Compression ratio 4.9. Mass air flow 85 lb. (38.6 kg.) per sec. at T.O. static thrust rating at sea level.
COMBUSTION CHAMBERS.—Eight tubular straight-through chambers with internal concentrically mounted perforated flame-tubes each containing at the closed front end a fuel atomiser or burner. Chambers



The Allison J35-A-33 axial-flow turbojet engine with afterburner.



The Allison J71 axial-flow turbojet engine which has a thrust rating of 9,700 lb. (4,400 kg.) without afterburning.

and flame tubes of stainless steel. Igniter plugs in two chambers. Chambers are interconnected to permit flame spread at starting and to equalise pressure during normal running.

FUEL SYSTEM.—Single manifold type. Incorporates Pesco fuel pump and Bendix speed density control.

FUEL GRADE.—Kerosene JP-3 MIL-F-5624.

NOZZLE GUIDE VANES.—Seventy-two steel guide vanes inserted in periphery of stainless steel diaphragm.

TURBINE.—Single-stage axial-flow turbine. Disc of stainless steel has 95 alloy steel blades. Maximum allowable gas temperature after turbine 1,300°F.

JET PIPE.—Stainless steel jet pipe with fixed inner cone. Details of afterburner not available.

AUXILIARY DRIVES.—Engine accessories mounted at front of engine.

LUBRICATION SYSTEM.—Dry sump pressure system.

STARTING. — Direct-drive starter-generator. Igniter plugs in two combustion chambers energised by G. E. transformers.

DIMENSIONS.—
Diameter 40.5 in. (1,030 mm.).
Overall length with afterburner 195.5 in. (4,965 mm.).

WEIGHTS (J35-A-33).—
Weight dry 2,230 lb. (1.012.4 kg.).
Components and accessories 495 lb. (224.7 kg.).
Total weight (with afterburner) 2,725 lb. (1,237 kg.).

PERFORMANCE (J35-A-33).—
Static thrust without afterburner over 5,200 lb. (2,360 kg.) at 7,900 r.p.m.

THE ALLISON J71 SERIES.

The J71 is a completely new engine embodying a number of notable changes in design.

A new combustion system incorporates what Allison calls a "cannular" burner section, in which ten individual combustion chambers are enclosed in a large outer annular type chamber. After compression and ignition in the outer chamber the mixture is bled into the inner "cans" where, in effect, the mixture is re-heated.

The J71 has sixteen stages of compression and a three-stage turbine, and it is fully equipped for all weather operation. Hot air can be bled from the compressor to the air-inlet vanes and central "bullet" and automatically retractable air inlet screens are provided. An automatic ice-detector is also supplied. The air inlet screens and the variable-area jet nozzle are hydraulically operated by the engine's own independent hydraulic system. It also has its own integral oil system.

DIMENSIONS.—
Diameter 37 in. (940 mm.).
Length (with tailpipe) 179 in. (4,550 mm.).

DRY WEIGHT.—
3,650 lb. (1,660 kg.).

PERFORMANCE.—
Static thrust without afterburner 9,700 lb. (4,400 kg.).
Thrust with afterburner about 13,000 lb. (5,900 kg.).

BOEING

BOEING AIRPLANE COMPANY.

HEAD OFFICE AND WORKS: SEATTLE 14, WASH.

Officers: See under "Boeing" on page 180.

In 1943, when the U.S. Army Air Forces became interested in the possibilities of using gas-turbines in large aircraft, the Boeing company decided to initiate its own propulsion research programme and a jet-propulsion laboratory was set up in the main plant at Seattle as a pure research project with the object of evaluating all data on gas-turbines. Later, the decision was made to build various turbine components and to evaluate them separately.

Axial-flow and centrifugal compressors and other components were built. Design studies progressed to the point where the original research project was expanded to embrace the complete assembly of experimental power-units, culminating in the design of many other small gas-turbines which are now being built in experimental and production quantities.

The first to run, the Boeing Model 500, is a two-burner turbo-jet developing 180 lb. (82 kg.) thrust at 36,000 r.p.m. This engine is suitable as a starter engine for larger jets or turbines, and may also be used as a thrust source for missiles, glide-bombs and small aircraft.

The other engines make use of the gas-producing section of the Model 500 and have been adapted for shaft-drive on the Model 502-2E and Model 502-8A, or compressed-air output on the Model 502-7B. The Boeing Model 502-10 gas turbine engine is a further development of the current production engine, the Model 502-2E. Through refinements of compressor and turbine designs and by increasing the pressure ratio of the compressor, the power output has been increased approximately by 20 per cent. and the specific fuel consumption has been decreased approximately by 20 per cent. A further increase in power and decrease in specific fuel consumption is expected before development is completed. The power-section, which has no mechanical connection with the gas-producing section, serves as a gaseous torque converter. Power developed by the gas producer is established by the throttle setting. Load for the shaft-drive engines on the output shaft determines the power-turbine speed and output.

First production contract for the Boeing Model 502 gas turbine engine was received in 1950. An unspecified number of these engines is being produced for the U.S. Navy Bureau of Ships and will be used to supply electrical power for mine-sweeper vessels.

A Cessna XL-19B, the World's first turboprop-powered light aeroplane, which is fitted with the new Boeing Model 502-8B engine, has been under test since November 5, 1952. This turbine-powered light aeroplane project is a joint development programme of the Cessna and Boeing companies and the U.S. Army and Air Force. The engine is an outgrowth of a joint Boeing—U.S. Navy programme of several year's duration.

A Kaman K-225 helicopter powered with a Boeing 502-2 (YT50) turbine flew for the first time on December 10, 1951, to become the first helicopter in the World in which the rotors are driven by turbine power.

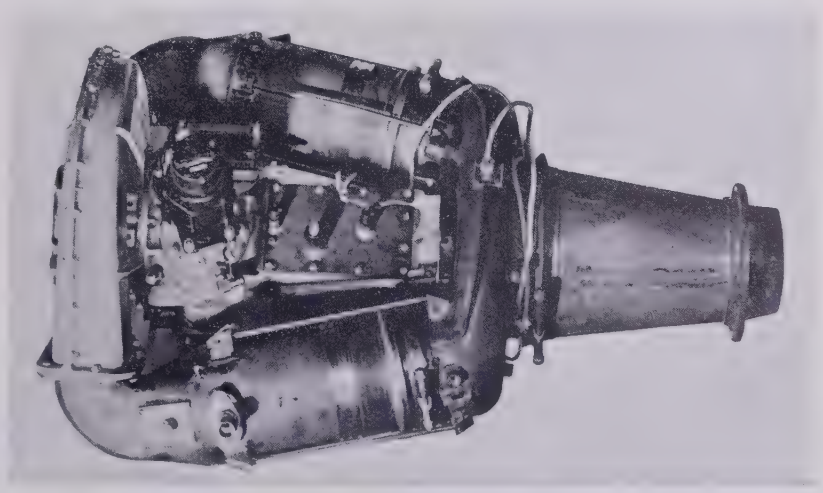
Tests on the company's ramjets, turbojets and guided missiles have continued.

THE BOEING MODEL 500-2.

TYPE.—Centrifugal-flow Turbojet.

AIR INLET.—Axial inlet in front of engine. Inlet air flow 3.6 lb. (1.63 kg.) per sec.

COMPRESSOR.—Single entry centrifugal compressor. Single-sided impeller with twenty-eight blades, fourteen full and fourteen half. Casing, which incorporates eight log-spiral aluminium-alloy diffuser passages had two tangential outlets and terminal elbows



The Boeing Model 500 turbojet which has a thrust rating of 190 lb. (60 kg.).

leading to combustion chambers. Compression ratio 3.15 : 1. Mass airflow 3.6 lb. (1.63 kg.) per sec.

COMBUSTION CHAMBERS.—Two cylindrical stainless steel through-flow combustion chambers with internal concentrically mounted Inconel flame-tubes, each containing at its upstream end a Simplex burner.

FUEL SYSTEM.—Single manifold type. Single lever control which actuates governor-controlled fuel pump delivery to burners. Maximum pressure 400 lb./sq. in. (28.12 kg./cm.²).

FUEL.—Commercially available kerosene, diesel fuel, gasoline or aviation jet fuel.

NOZZLE GUIDE VANES.—Twenty-seven nozzle guide vanes of Haynes Stellite 21 inserted in periphery of steel diaphragm.

TURBINE.—Single-stage turbine. Fifty-six solid Haynes stellite blades welded to rim of Timken alloy-steel rotor disc. Gas temperature before turbine 1,550°F., after turbine 1,300°F.

JET PIPE.—Stainless steel sheet jet pipe.

ACCESSORY DRIVES.—Four gear-driven accessory drive pads at top of gas producer. Fuel pump and governor unit, starter-generator, tachometer and oil pump.

LUBRICATION SYSTEM.—Integral with engine except for oil cooler and filter. Oil sump is part of the engine base and has a capacity of 4 U.S. quarts. One Lear-Romec RD-7150A rotary-vane pump with one pressure unit (60 lb./sq. in. = 4.2 kg./cm.²) and one scavenge unit.

OIL SPECIFICATION.—MIL-0-2104 grade S.A.E. 10.

STARTING.—24-volt starter-generator unit in accessory drive. Attachment for air-starting can be supplied if required. Two igniter plugs and two spark coils.

DIMENSIONS.—
Diameter 22.20 in. (559 mm.).
Length (without jet pipe) 29.76 in. (736 mm.).
Length overall 31.70 in. (805 mm.).
Frontal area 2.2 sq. ft. (0.204 m.²).

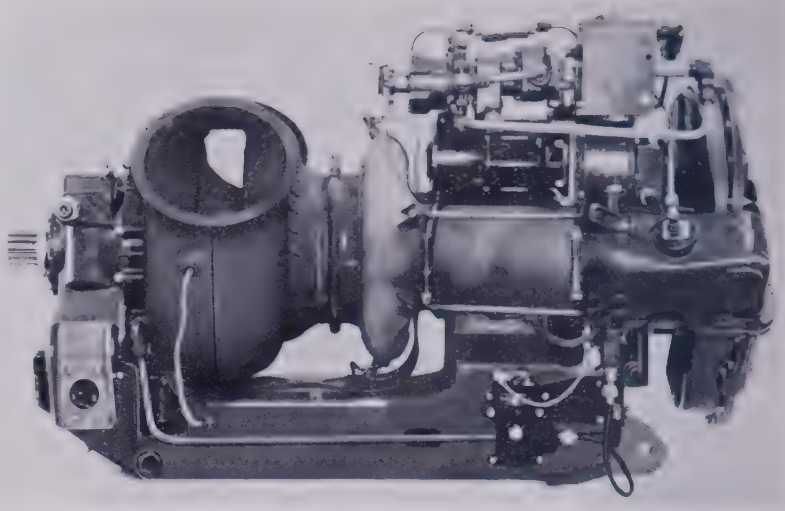
WEIGHT.—
120 lb. (54.5 kg.).

PERFORMANCE RATINGS (At S/L.—NACA Standard conditions).—
Take-off 195 lb. (88.5 kg.) at 37,500 compressor r.p.m.
Normal or continuous 170 lb. (77.2 kg.) at 36,500 r.p.m.

CONSUMPTIONS.-
Fuel take-off 1.35 lb./lb. s.t./hr. (1.35 kg./kg. s.t./hr.).
Fuel normal or continuous 1.37 lb./lb. st. hr. (1.37 kg./kg. s.t./hr.).
Oil negligible.

THE BOEING MODEL 502-2E.
U.S. Navy designation: YT50.

TYPE.—Centrifugal-flow Turboprop comprising separate gas producer and power output sections.



The Boeing Model 502-2E turboprop engine.

PROPELLER DRIVE.—Shaft driven by second-stage power output turbine through planetary reduction gear. Gear ratio 8.62 : 1.

AIR INTAKE.—Axial inlet aft. Inlet air flow 3.6 lb./sec. (1.63 kg./sec.).

COMPRESSOR.—Same as for Model 500.

COMBUSTION CHAMBERS.—Same as for Model 500.

FUEL SYSTEM.—Same as for Model 500. Maximum fuel pressure 450 lb./sq. in. (31.5 kg./cm.²).

FUEL GRADE.—Diesel fuel, kerosene, gasoline or aviation jet fuel.

NOZZLE GUIDE VANES.—Fixed. Twenty-seven in both first and second stages.

TURBINE.—Two-stage turbine with no mechanical connection between the first (36,000 r.p.m.) and second (25,000 r.p.m.) stages except for shroud and engine frame. Gases from first stage-turbine pass through a nozzle box and are expanded through the second stage turbine which drives the output shaft. Both turbines are alloy steel discs to the rims of which are welded fifty-six (first stage) and forty-four (second stage). Solid alloy blades. Gas temperature before turbine 155°F., after turbine 1,200°F. (exhaust temperature).

JET PIPE.—Annular exhaust manifold with bifurcated outlets to clear reduction gear housing.

ACCESSORY DRIVES.—Four gear-driven accessory drive pads on gas producer section and two on reduction-gear housing. Fuel pump and governor, starter and starter generator, power turbine governor, and two tachometer generators (one on gas producer section and one on power output section).

LUBRICATION SYSTEM.—Integral with engine except for oil cooler and filter. Oil sump is part of the gas producer section and has a capacity for 4 U.S. quarts. One Lear-Romec RD-7150A rotary vane-type pump with one pressure unit (60 lb./sq. in.=4.2 kg./cm.²) to supply oil to main bearings, accessory drives and reduction gear, and one scavenge unit.

OIL SPECIFICATION.—MIL-0-2104 S.A.E. 10.

STARTING.—24-volt 30-amp. starter-generator unit in accessory drive. Attachment for air starting can be supplied if required.

DIMENSIONS.—
Width 23.2 in. (589 mm.).
Length 39.89 in. (1,013 mm.).
Height 24.43 in. (620 mm.).
Frontal area 2.2 sq. ft. (0.204 m.²).

WEIGHT.—
230 lb. (104.4 kg.).

RATING (At S/L.—NACA Standard condition).—
Max. continuous (static) 175 s.h.p. at 2,900 s.r.p.m. at sea level.

CONSUMPTIONS.—
Fuel (normal) 1.3 lb./h.p./hr. (0.508 kg./h.p./hr.).
Oil (cruising) negligible.

THE BOEING MODEL 502-8B.

The Model 502-8B is basically similar to the previously-described Model 502-2E but has several refinements. It powers the Cessna XL-19B, the World's first turboprop-powered light aeroplane.

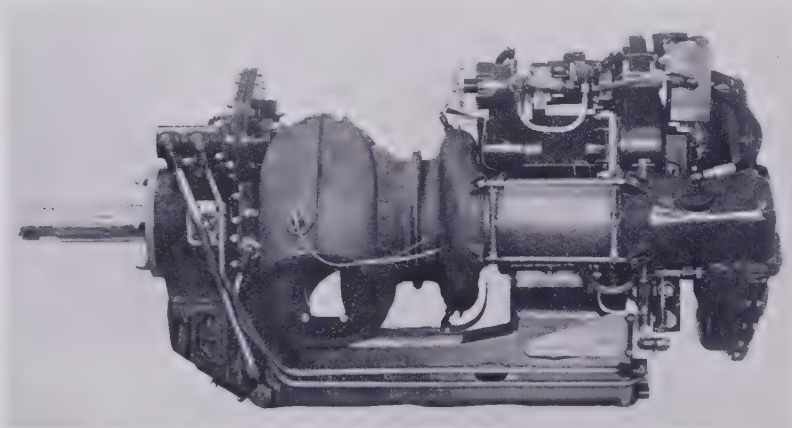
PROPELLER REDUCTION GEAR RATIO.—
8.62 : 1.

DIMENSIONS.—
Width 23.20 in. (589 mm.).
Length 46.83 in. (1,189 mm.).
Height 24.60 in. (625 mm.).
Frontal area 2.2 sq. ft. (0.204 m.²).

WEIGHT.
267 lb. (121.2 kg.).

PERFORMANCE RATINGS (At S/L.—NACA standard conditions).—
Take-off 210 h.p. at 37,500 compressor r.p.m. (2,450 shaft r.p.m.).
Continuous 175 h.p. at 36,000 compressor r.p.m. (2,300 shaft r.p.m.).

CONSUMPTIONS.
Fuel take-off 1.25 lb./h.p./hr. (0.567 kg./h.p./hr.).
Fuel normal 1.30 lb./h.p./hr. (0.508 kg./h.p./hr.).
Oil negligible.



The Boeing Model 502-8B turboprop engine.

FAIRCHILD

FAIRCHILD ENGINE DIVISION, FAIRCHILD ENGINE AND AIRPLANE CORPORATION.

ENGINE DIVISION, HEAD OFFICE AND WORKS: FARMINGDALE, LONG ISLAND, N.Y.

OTHER WORKS: VALLEY STREAM AND MINEOLA, LONG ISLAND, N.Y.

Vice-President and General Manager: George F. Chapline.

Assistant General Manager: E. M. Lester.

Chief Engineer: A. T. Gregory.

The Fairchild Engine Division is engaged in considerable power-plant research and development work for the Bureau of Aeronautics and the Bureau of Ordnance, Navy Department.

This work includes the development and production of gas-turbine engines for both piloted and pilotless aircraft and guided missiles, and design and development work on a number of other unconventional engines. In addition, Fairchild is producing in quantity major components of the General Electric J47 turbojet engine and is manufacturing the V-32 D-2 auxiliary power-plant, comprising a reciprocating engine and generator, which is used in virtually every American military aircraft in the bomber and transport classes.

The Engine Division is also engaged in an extensive research and development programme with active contracts from all three branches of the Armed Services. For the U.S. Navy the Division holds a contract for the development

and construction of a midget submarine with the designation X-1, the first to be contracted for by the Bureau of Aeronautics. Emphasis, however, in the overall research programme is on the development of specialised power-plants and related components for use on land, on the sea and in the air.

The only recent Fairchild aeronautical product of which brief details may be given is the J44 turbojet which is being produced for both the U.S. Navy and Air Force.



The Fairchild J44 expendable turbojet engine.

THE FAIRCHILD J44.

The J44 is a small axial-flow turbojet engine which has many possible applications. Primarily it is intended to power target drones and guided missiles, and its first announced use is as the power-plant of the Ryan Firebee high-speed pilotless target aircraft. Design work began in 1948 and the engine passed its qualification tests early in 1950, but it still remains on the classified list.

The J44, which is designed to be a self-contained power-plant needing only a minimum of services from the airframe, features an outer sheet metal monocoque shell which forms both a pressure chamber and a frame structure connecting the two main bearing supports. Its smooth outer shell, which carry the main stresses of the engine, eliminates the need for additional cowling in certain types of installations.

All accessories, including the essential controls and an electric starter-generator, are grouped in a self contained section which can be quickly replaced in the field.

The engine has its own oil storage and requires no oil coolers, pumps or external oil lines. Internal oil capacity for more than ten hours of operation can be provided.

Two mounting methods are available. Due to inherent rigidity, it can be installed without any aft support in a cantilever mounting attaching to the front of the compressor section. It can also be trunnion mounted at the sides of the compressor section with a rear stabiliser at the rear bearing support frame.

DIMENSIONS.—
Length approx. 72 in. (182.8 cm.).
Diameter 22 in. (55.8 cm.).
WEIGHT (complete with accessories).—
325 lb. (147.5 kg.).
PERFORMANCE RATING.—
Static thrust 1,000 lb. (454 kg.).

GENERAL ELECTRIC

AIRCRAFT GAS TURBINE DIVISION, GENERAL ELECTRIC COMPANY.

HEAD OFFICE : CINCINNATI 15, OHIO.

Vice-President (General Electric Company) and General Manager (Aircraft Gas Turbine Division) : C. W. LaPierre.

Manager—Operations : H. W. Chandler.

Manager—Finance : M. E. Moulton.

Manager—Contracts : E. S. Thompson.

Manager—Manufacturing (Cincinnati) : B. W. Mahoney.

Manager—Manufacturing (Lynn, Mass.) L. T. Callahan.

Manager—Projects : Marc de Ferranti.

Manager—Development : Neil Burgess.

Manager—Sub-contracting : G. E. Fouch.

Manager—Aircraft Nuclear Propulsion Project : D. R. Shoults.

Manager—Service Engineering : D. T. Richardson.

The General Electric Company entered the gas-turbine field about 1895. Years of pioneering effort by the late Dr. Sanford A. Moss produced the aircraft turbo-supercharger, successfully tested at height in 1918 and mass-produced in World War II for U.S. fighters and bombers.

In October, 1941, by arrangement between the British and American Governments, a complete Whittle WIX engine, a set of drawings of the Whittle W2B, the prototype of the Rolls-Royce Welland engine, and a small team of engineers from Power Jets, Ltd. were flown to America to assist General Electric to initiate the manufacture of turbo-jet engines in the United States.

The first experimental General Electric jet engine was the I-A, a copy of the Whittle W2B. Two I-A's were installed in the Bell XP-59A, the first U.S. jet-propelled aircraft to fly. The first flight of the XP-59A was made in October, 1942 within twelve months of the arrival of the Whittle engine and British engineers in the United States.

The first series production G.E. engine was the I-16 and this was followed in 1944 by the I-40, or J33, which was chosen to power the Lockheed P-80A Shooting Star. After the war complete responsibility for the J33 was transferred to the Allison Division of General Motors.

The first G.E. axial-flow engine was the TG-180, or J35. Late in 1947 complete responsibility for the J35 design was also transferred to Allison.

General Electric's current production is the J47, of which there are several models. J47 engines power the Boeing B-47, North American F-86A, F-86D, F-86E and FJ-2, Convair B-36 (wing jet pods), Republic XF-91 and Martin XB-51. A new and much more powerful turbojet, the J73, was put into production early in 1953.

The first turboprop to be designed and tested in the United States, and the first to fly, was the General Electric TG-100.

In 1950 General Electric acquired the name, patents and technical data of the Turbodyne Corporation, a research subsidiary of Northrop Aircraft, Inc. General Electric now owns the patent and rights to what is believed to be the most powerful turboprop power-plant in the World. Because the company felt that improvements of gas-turbine power-plants, whether turboprop or turbojet, could best be achieved by concentrating on further development of the turbojet, major development effort on the turboprop was discontinued. General Electric is continually examining requirements for turboprops and is in a position to accelerate development as the demand warrants.

In February, 1951, negotiations were initiated between the U.S. Air Force, the Atomic Energy Commission and General Electric for the development of a nuclear power-plant for aircraft. On July 1st, 1951, D. R. Shoults was appointed manager of the General Electric's Aircraft Nuclear Propulsion Project for the Air Force and Atomic Energy Commission. This project is now under way at General Electric's Cincinnati plant.

General Electric is still developing and manufacturing turbo-superchargers of various types for maintaining of the power of piston engines at altitude.

In 1952 an accessory turbine section was established to handle the development, manufacture and sale of aircraft turbine accessory equipment. The new section will market such accessories as gas-turbine starters, turbo-pumps, turbo-superchargers, impellers and air turbine drives. One of the newer products is a small aircraft auxiliary gas-turbine which can start a jet engine without the aid of ground power units.

THE GENERAL ELECTRIC J47 SERIES.

The J47 is a development of the J35, the development and production of which is now the responsibility of the Allison Division of General Motors. Although of approximately the same size and weight as the J35, the current production model J47 has a dry thrust rating of over 5,800 lb. (2,630 kg.), as compared with 4,000 lb. (1,816 kg.) of its predecessor.

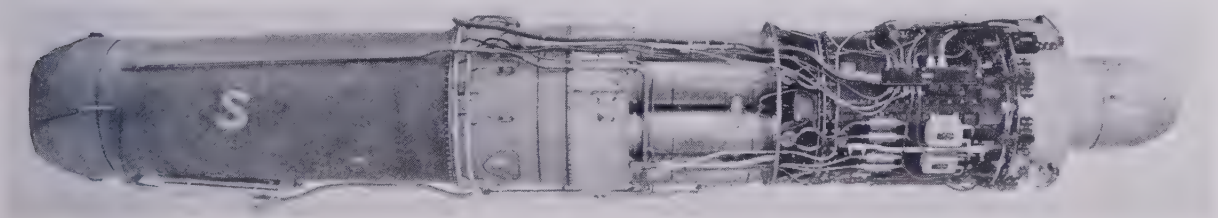
The first installation of the J47 was in the North American F-86A single-seat fighter. In 1948 a standard F-86A established a new World's Speed Record of 670.981 m.p.h. (1,073.5 km.h.).

In 1953 this record was raised to 715.697 m.p.h. (1145.1 km.h.) by a North American F-86D powered by a J47-GE-17 engine with afterburner. Unique in the F-86D are the General Electric automatic electronic engine controls which regulate the fuel flow for best performance throughout all combinations of speed, altitude, engine r.p.m., temperature and other factors affecting engine performance.

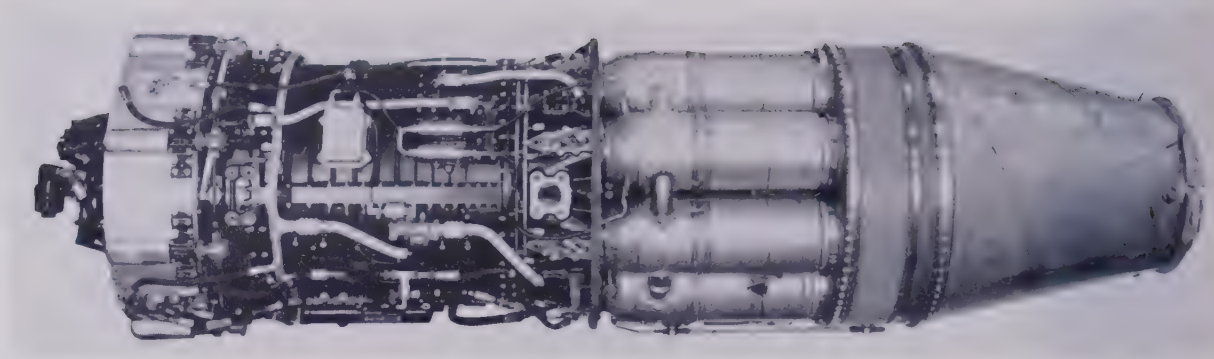
The following are some of the models of the J47 installed in current U.S.A.F. aircraft :—

J47-GE-2. Installed in the North American FJ-2 Fury.

J47-GE-11. Installed in the Boeing B-47A.



The General Electric J47-GE-17 axial-flow turbojet engine with afterburner.



The General Electric J47-GE-23 axial-flow turbojet engine.

J47-GE-13. Installed in the North American F-86A, F-86E, B-45 and Republic XF-91. Modified version installed in the Martin XB-51.

J47-GE-15. Installed in the North American B-45.

J47-GE-17. Installed in the North American F-86D. Basically the same as -11, -13 and -15 engines except fitted with afterburner; new compressor having higher efficiency and greater airflow; new high-altitude starting system of opposite polarity type; and new electronic controls. Engine is completely anti-iced with hot air bled from compressor to air inlet guide vanes, fairings and support struts. Air inlet screen is retractable after take-off. Considerable reduction in use of strategic materials.

J47-GE-19. Installed in jet-pods of Convair B-36D. Same data as -11, -13 and -15 except that this model has high-altitude ignition and starting system.

J47-GE-23. Installed in Boeing B-47A. Basically same as -17 but without afterburner, and hydraulic control instead of electronic.

J47-GE-25. Installed in Boeing B-47B. Rated at over 5,800 lb. (2,630 kg.) dry. In production by General Electric and by the Packard Motor Company and the Studebacker Corporation to G.E. design.

J47-GE-27. Installed in North American F-86E and F-86F. Has lower fuel consumption and is anti-iced.

The brief details below refer specifically to the J47-GE-11, -13 and -15 models.

TYPE.—Axial-flow Turbojet.
AIR INLET.—Annular inlet. Inlet air flow 92 lb. (41.7 kg.) per sec.
COMPRESSOR.—Twelve-stage axial-flow. Compression ratio 5 : 1.
COMBUSTION CHAMBERS.—Eight through-flow chambers.
FUEL SYSTEM.—Positive displacement gear-type fuel pump. Hydraulic fuel control system. Provision for water injection.
FUEL GRADE.—JP-1, 2, 3 or 4 turbofuel, or Mil-F-5572 gasoline.
TURBINE.—Single-stage axial-flow turbine.
JET PIPE.—Fixed inner cone and sheet steel outer casing. Maximum tailpipe temperature 1,275°F. Afterburner on J47-GE-17.
LUBRICATION SYSTEM.—Pressure feed to main components with return oil system to bearings and accessory gears.
STARTING.—General Electric starter generator. Two igniter plugs and two coils.
DIMENSIONS.—
Length 144 in. (3,658 mm.).
Length (J47-GE-17 with afterburner) 226 in. (5,715 mm.).
Diameter 36.75 in. (933 mm.).
Frontal area 7.4 sq. ft. (0.68 m.²).
WEIGHT DRY.—
Approx. 2,500 lb. (1,135 kg.).
PERFORMANCE RATINGS.—
Take-off (static) 5,200 lb. (2,360 kg.) at 7,950 r.p.m.
Normal thrust 4,730 lb. (2,147 kg.) at 7,630 r.p.m.
Best cruise thrust 3,700 lb. (1,680 kg.) at 7,000 r.p.m.
CONSUMPTIONS.—
Fuel (best cruise rating) 1.03 lb./lb. st./hr. (1.03 kg./kg. s.t./hr.).
Oil (max.) 2.0 lb./hr. (0.91 kg./hr.).

THE GENERAL ELECTRIC J73 SERIES.

The J73 Series incorporates a number of new features as compared with the J47 previously described. These include the so-called "cannular" type of combustion system, consisting of a single combustion space containing individual "cans"; a new compressor permitting a greater flow of air through the engine and a higher compression ratio; a larger air inlet area achieved by re-locating some accessories below engine; "all-weather" features, including hot-air anti-icing and retractable air inlet screens, etc. Exhaust temperatures are controlled electrically. The oil is cooled by the engine fuel and is contained in a tank on the engine. Either water/alcohol injection or afterburning may be used, and a variable tail-pipe exhaust nozzle may be fitted.

The following engines in the J73 Series have been identified:—

J73-GE-1. Basic J73 engine incorporating features mentioned above.

J73-GE-3. Similar to -1 but with modification of accessory mountings and other minor changes.

J73-GE-5. -1 engine with afterburner.

DIMENSIONS.—
Diameter 39.5 in. (1,005 mm.).
Length 200.0 in. (5,080 mm.).
Frontal area 8.5 sq. ft. (0.79 m.²).
WEIGHT.—
Dry 3,600 lb. (1,635 kg.).
PERFORMANCE RATING.—
Take-off (static) 9,200 lb. (4,170 kg.).
CONSUMPTION.—
Fuel 0.90 lb./lb. thrust/hr. (0.90 kg./kg thrust/hr.).

MARQUARDT

MARQUARDT AIRCRAFT COMPANY.

HEAD OFFICE AND WORKS: 7801 HAYVENHURST AVENUE, VAN NUYS, CALIFORNIA.

President: Roy E. Marquardt.
Vice-President: George P. Tidmarsh.
Manager, Engineering and Manufacturing: Don. L. Walter.
Manager, Customer Relations: Patrick A. Sisson.
Chief Engineer: John A. Drake.
Administrative Engineer: Brooks T. Morris.
Chief Project Engineer: Robert K. Wead.
Secretary and Treasurer: William H. Schwebel.

The Marquardt Aircraft Company was formed in November, 1944 to undertake the research and development of subsonic ramjet engines, and at that time it was the only company to be engaged exclusively in this work in the United States.

Testing techniques and facilities were without precedent; manufacturing methods were undeveloped; empirical data on ramjet engine performance and the required knowledge of the high-temperature behaviour of materials were then non-existent. These and many other problems had to be met before early tests proved successful and Government contracts were forthcoming.

The first of these contracts was for the development of a 20-inch diameter subsonic ramjet developing the equivalent of 2,500 horsepower. Then following similar contracts for larger engines of 30 and 48 inch diameters and of proportionally higher thrusts in the subsonic range, as well as for supersonic ramjet engines in varying sizes and types. More than fifty of the 20-inch engines were tested on various piloted aircraft and guided missiles of the U.S. armed forces. The first piloted flight was made with a Lockheed F-80 Shooting Star fitted with a Marquardt 20-inch ramjet at each wing-tip. During flight the normal power-plant of the F-80 was switched off to achieve pure ramjet flight.

The first production order for ramjet engines was awarded for Marquardt C-20 20-inch engines for installation in the U.S. Navy KDM-1 drones being manufactured by the Glenn L. Martin Company. Other accomplishments in the subsonic field, as well as all results in the development of supersonic ramjets are restricted by Government security regulations.

The company is also active in the production of pulsejet engines for use in target drones.



Marquardt C-20 ramjet engines for installation in Martin KDM-1 Target Drones.

The company also develops and manufactures fuel control equipment and air and hydrogen peroxide turbine-driven accessory power-plants to meet the hydraulic, electrical and fuel-pump requirements of ramjet and rocket-powered missiles and turbojet-powered aircraft.

The Marquardt jet laboratory is one of the most powerful facilities in the United States for the testing of ramjet and pulsejet engines and related equipment and accessories. It is capable of testing full-scale flight ramjet engines and can simulate speeds approaching 2,000 m.p.h. (3,200 km.h.) and altitudes above 50,000 ft. (15,250 m.).

THE MARQUARDT C-20.

U.S. Navy designation : RJ-30-MA-6.

TYPE.—Subsonic Ramjet.

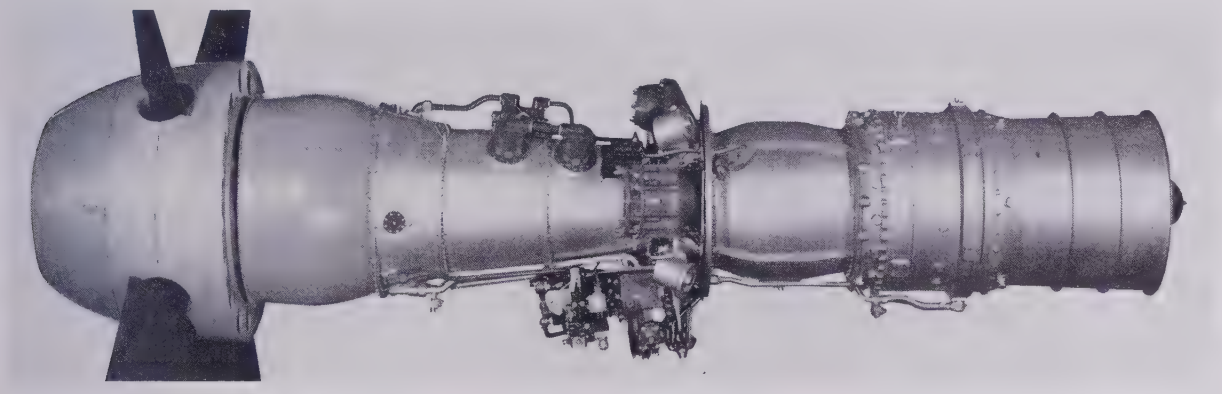
MAXIMUM EXHAUST TEMPERATURE.—Over 3,000°F.

DIMENSIONS.—
Max. length 87.25 in. (221.6 cm.).
Diameter 20.0 in. (50.8 cm.).

WEIGHT DRY.—
126 lb. (57.2 kg.).

PERFORMANCE RATINGS.—
Max. net thrust 1,450 lb. (660 kg.).
Rated net thrust 1,200 lb. (545 kg.).

PRATT & WHITNEY



The Pratt & Whitney T34 turboprop engine which has a rating of 5,500 e.s.h.p.

THE PRATT & WHITNEY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS : East Hartford 8, Connecticut.

General Manager : William P. Gwinn.

Engineering Manager : Wright A. Parkins.

Chief Engineer : Perry W. Pratt.

Sales Manager : T. E. Tillinghast.

Factory Manager : John L. Bunce.

Pratt & Whitney Aircraft entered the gas-turbine engine field in 1947 by acquiring the American manufacturing and sales rights for the Rolls-Royce Nene engine. These rights were later expanded to include the Rolls-Royce Tay, a development of the Nene. Both these engines have been developed to meet U.S. Navy requirements and to incorporate materials, parts and accessories from United States sources. As the J42 and J48, respectively, they have been produced in quantity to power mainly the Grumman F9F Panther. The J42 is now out of production.

In 1953 Pratt & Whitney was in production with axial-flow engines of extremely high power of its own design, while continuing in volume production of the J48 centrifugal-flow engine. By the beginning of 1953 nearly half of the company's production capacity was devoted to the production of gas-turbine engines.

THE PRATT & WHITNEY T34 TURBO-WASP.

The T34 Turbo-Wasp is a single-unit high-pressure axial-flow turboprop engine, the active development of which was begun in June, 1945 under the auspices of the U.S. Navy Bureau of Aeronautics as part of the Navy's overall programme to develop this type of power-plant. A T34 engine completed a preliminary 50-hour flight rating test at 5,700 h.p. and flight testing in the nose of a Boeing B-17 began in August, 1950.

The T34 has been selected by the U.S. Navy for installation in two Lockheed R7V Super-Constellations in a programme designed to test the potentialities of turboprop-powered transports, and by the U.S.A.F. for installation in a Douglas YC-124B transport in a similar programme.

In December, 1951, the T34 completed a 50-hour pre-flight test at a rating of 5,500 h.p. e.s.h.p. with a specific fuel consumption that compares favourably with that of piston engines in the highest power ratings.

The T34 has a 13-stage axial-flow compressor with an annular type burner and a three-stage axial-flow turbine. Stainless steel is used almost exclusively in the construction of the T34.

The propeller reduction gear is flexibly coupled to the front of the compressor shaft and the compressor and turbine are rigidly coupled at the rear of the compressor case. The reduction gear uses two stages and operates at a 11 : 1 ratio.

The engine incorporates a mechanical control system in which a single lever is linked to mechanical controls that automatically control the fuel flow and coordinate it with propeller speed, flight speed and altitude for the particular power selected by the pilot.

De-icing is accomplished by hot air bled from the engine to the air inlet area.

The basic weight of the T34 is 2,550 lb. (1,158 kg.). At the present power output this gives a ratio of more than two horsepower per pound of engine weight.

The basic diameter of the engine is 30 inches (76.2 cm.) and the length 155 inches (393.4 cm.).

THE PRATT & WHITNEY PT2F-1.

The PT2F-1 is the commercial version of the T34 military turboprop engine previously described. This engine was made available for civil use in the United States and abroad in 1953.

DIMENSIONS.—
Max. diameter 34.06 in. (865 mm.).
Max. length 157.4 in. (3,998 mm.).

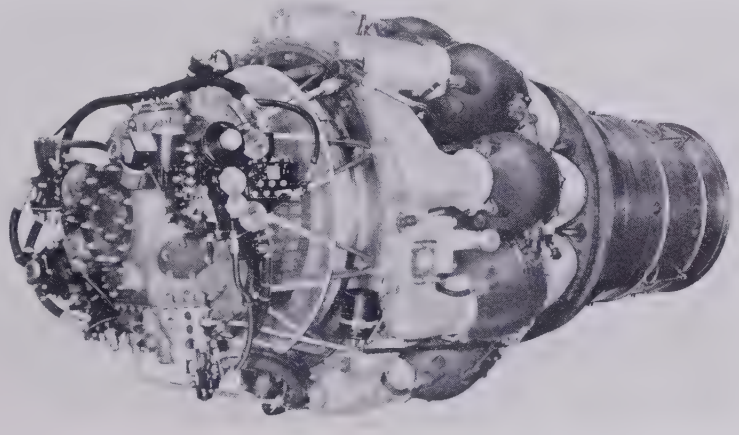
WEIGHT DRY.—
2,564 lb. (1,164 kg.).

PERFORMANCE.—
T.O. power 5,600 e.h.p. (5,100 s.h.p.) at 11,000 r.p.m.
Normal rated power 4,850 e.h.p. (4,400 s.h.p.) at 10,750 r.p.m.
Cruising output (85% rated) 4,145 e.h.p. (3,740 s.h.p.) at 10,570 r.p.m.
Cruising output (60% rated) 2,990 e.h.p. (2,640 s.h.p.) at 10,250 r.p.m.

THE PRATT & WHITNEY J57 TURBO-WASP.

The J57 is a large axial-flow turbojet engine of Pratt & Whitney design, of which no details were available at the time of going to press. It was claimed, however, that at the time of its first flights in a Boeing B-50 flying test-bed, it was the most powerful turbojet flying in the U.S.A.

The J57 powers the Boeing B-52 eight-jet heavy bomber and the North American YF-100 fighter and will be fitted to the Convair F-102 and several other



The Pratt & Whitney J48 turbojet engine.

advanced military aircraft now under development.

It has also been chosen to power the Boeing Model 707, America's first jet-powered airliner which is due to fly in 1954.

To supplement Pratt & Whitney's own production, the company has licensed the Ford Motor Company to build the J57 in its Chicago plant.

THE PRATT & WHITNEY J48 TURBO-WASP.

The J48 Turbo-Wasp is the result of pooling of the engineering talents of two of the World's leading engine builders—Pratt & Whitney Aircraft and Rolls-Royce, Ltd. The basic design is Rolls-Royce, the British version of the J48 being known as the Tay.

The J48 is a development of the J42 which is the Pratt & Whitney-built Nene. A re-designed impeller and larger turbine blades enables the J48 to consume 30 per cent. more air and in turn, to produce more thrust. The J48 is, however, essentially interchangeable with the J42 because dimensional differences are slight. One of Pratt & Whitney's main independent contributions to the J48 is the afterburner.

This engine powers the Grumman F9F-5 and F9F-6, and the Lockheed F-94C.

To supplement the company's own production the Chrysler Corporation has been licensed by Pratt & Whitney to build the J48 and afterburner, for which purpose Chrysler is erecting a new plant near Detroit, Mich.

DIMENSIONS.—
Diameter 50 in. (1,270 mm.).
Length (without afterburner) 106.75 in. (2,712 mm.).

WEIGHT DRY.—
2,000 lb. (908 kg.).

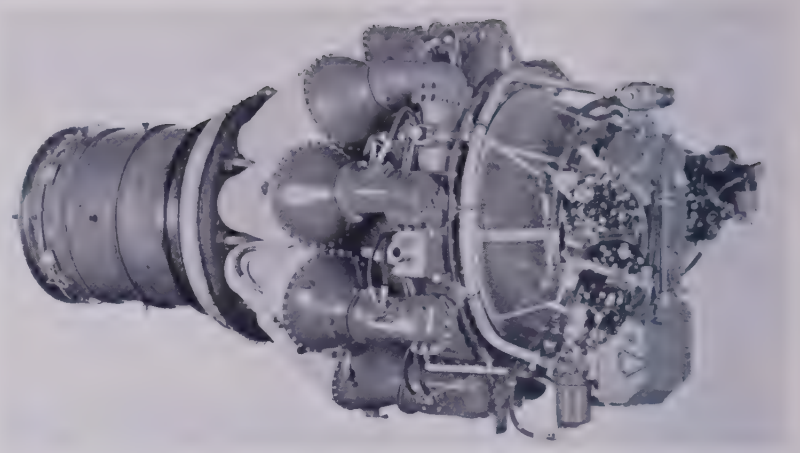
PERFORMANCE Ratings.—
Static thrust (dry) at sea level 6,250 lb. (2,840 kg.).

THE PRATT & WHITNEY J42 TURBO-WASP.

TYPE.—Centrifugal-flow Turbojet.

AIR INLET.—Double-sided annular inlet delivering air to both sides of impeller. Inlet air flow 88 lb./sec. (40 kg./sec.).

COMPRESSOR. — Single-stage double-entry centrifugal compressor with double-sided impeller. Aluminium-alloy impeller has twenty-nine vanes per side with separate forged aluminium rotating guide vanes machined all over. Magnesium-alloy casing. Aluminium-alloy difuser having nine



The Pratt & Whitney J42-P-8 turbojet engine.

outlets and internally-vaned elbows connecting with combustion chambers. Impeller shaft is attached to turbine shaft by spherical splined coupling and runs on two bearings, roller at front and ball (thrust) at rear end. Fan on shaft between impeller and centre bearing directs cooling air to turbine disc and rear bearings. Compression ratio 4.3 : 1.

COMBUSTION CHAMBERS.—Nine straight-through combustion chambers each with a concentrically-mounted perforated flame tube containing a duplex burner at its front end. Igniter plugs in Nos. 3 and 8 chambers. Interconnecting pipes between all chambers for flame spread at starting.

FUEL SYSTEM.—Two Lucas or Bendix pumps of oscillating multi-plunger type draw fuel through low-pressure filter and deliver to burners through Bendix fuel control system. Altitude-compensated power and speed controls. Provision for water/methanol injection.

FUEL GRADE.—Gasoline 100/130 Grade, or JP-3 and JP-4 Turbofuel.

NOZZLE GUIDE VANES.—Forty-eight nozzle guide vanes of cast steel. Rear end of combustion chamber located freely in discharge nozzle box to permit differential expansion.

TURBINE.—Single-stage turbine comprising solid steel disc and 54 blades of special steel-alloy inserted in periphery. Disc bolted to shaft.

JET PIPE.—Consists of fixed cone and stainless steel jet pipe, which may vary in length according to installation.

ACCESSORY DRIVES.—Magnesium wheel-case on front of engine driven from compressor shaft, with drives for fuel pumps, fuel controls, aircraft accessory gear-box, starter, generator, tachometer and hydraulic pump.

LUBRICATION SYSTEM.—Dry sump. Pump incorporates pressure and scavenger units. Filtered pressure oil to wheel-case and main bearings.

MOUNTING.—Two trunnions on turbine casing and a bottom support.

STARTING.—Electric starter motor on wheel-case. Two flame igniters, one each in Nos. 4 and 7 combustion chambers.

DIMENSIONS.—
Diameter 49.5 in. (1,257 mm.).
Length (without extension pipe or jet nozzle) 103.25 in. (2,623 mm.).

WEIGHT DRY.—
1,729 lb. (788 kg.).

PERFORMANCE RATINGS.—
Take-off (with coolant injection) 5,750 lb. (2,610 kg.) static thrust at 12,300 r.p.m.
Take-off (dry) 5,000 lb. (2,270 kg.) static thrust at 12,300 r.p.m.
Normal (static) 4,000 lb. (1,816 kg.) at 11,600 r.p.m.
Cruise (static) 2,700 lb. (1,226 kg.) at 10,500 r.p.m.

CONSUMPTIONS.—
Fuel (take-off) 1.12 lb./lb. thrust/hr. (1.12 kg./kg. thrust/hr.) max.
Fuel (normal rating) 1.09 lb./lb. thrust/hr. (1.09 kg./kg. thrust/hr.) max.
Oil (max. sea level static) 1.5 lb./hr. (0.68 kg./hr.).

REACTION MOTORS

REACTION MOTORS, INC.

HEAD OFFICE, WORKS AND LABORATORY: ROCKAWAY, NEW JERSEY.

President: Raymond W. Young.

Reaction Motors, Inc. designed and built the first rocket-type power-unit for aircraft use to be developed in the United States. This engine, which carries the designation 6000C4, operates from the controlled combustion of a fuel (alcohol-water mixture) and an oxidizer (liquid oxygen), which are brought together in four steel cylindrical combustion chambers and expansion nozzles, of which any one or all can be operated at the same time. On a basic weight of 210 lb. (95.3 kg.) the engine develops a maximum thrust of 6,000 lb. (2,725 kg.).

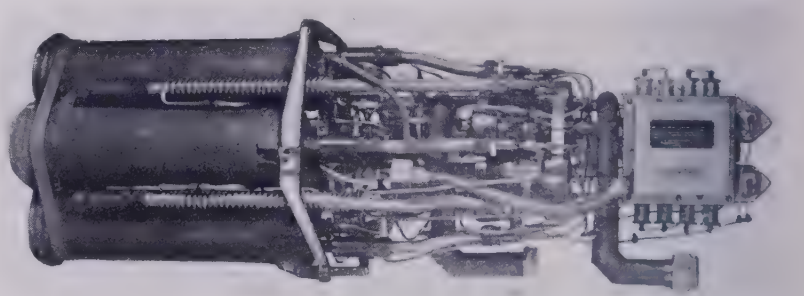
The first practical application of this unit was in the Bell X-1, which was the first American aircraft to exceed the speed of sound.

Other models of Reaction Motors rocket engines power the Douglas D-558-2 Skyrocket, the Republic XF-91 and the U.S. Navy's Lark and Viking missiles. The D-558-2 Skyrocket, on rocket power alone, has flown at a speed of 1,238 m.p.h. (1,981 km.h.) and has reached an altitude of 79,494 ft. (24,245 m.).

REACTION MOTORS MODEL 6000C4 ROCKET.

TYPE.—Liquid bi-propellant Rocket.

CONSTRUCTION.—Chrome-molybdenum steel



The Reaction Motors Model 6000C4 liquid rocket motor.

girder frame supports the combustion chambers, fuel supply and control system, and includes centrally-disposed transverse frame for attachment to airframe. Stainless steel tubular combustion chambers have closed front ends and venturi-type expansion nozzles.

PROPELLANT.—Ethyl alcohol (fuel) and liquid oxygen (oxydiser) are injected into front end of combustion chambers under pressure supplied by helium gas or pressurised nitrogen and ignited. Four control valves each in fuel and oxydiser lines to ensure uniform pressure at entry to chambers.

IGNITION.—Separate igniter in each chamber. Igniter uses fuel/oxydiser mixture which is fired by B.G. igniter plus and Eclipse coil. Electrically operated from control box on front of engine. Chambers can be fired individually, in any combination or all together.

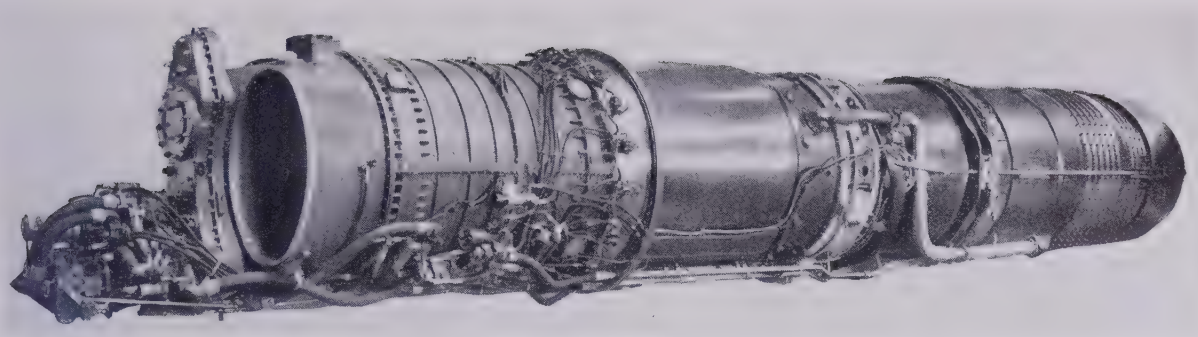
COOLING.—Regenerative. Fuel before injection is circulated through coolant passages in exhaust nozzles and around combustion chambers.

MOUNTING.—Four circumferentially-located mounting points on main frame.

DIMENSIONS.—
Diameter 19.0 in. (48.26 cm.).
Length 56.0 in. (142.24 cm.).
Frontal area 2.0 sq. ft. (0.186 m.²).

WEIGHTS.—
Weight dry 210 lb. (95.34 kg.).
Weight/thrust ratio 0.035 lb./lb. thrust (0.035 kg./kg. thrust).

PERFORMANCE.—
Max. rating 6,000 lb. (2,725 kg.) thrust at any altitude.
Jet velocity 6,182 ft. (1,885.5 kg.) per sec.
Specific impulse 192 sec.
Propellant consumption 0.0052 lb./lb. thrust/sec.



The Westinghouse J40-WE-8 axial-flow turbojet engine with afterburner.

WESTINGHOUSE ELECTRIC CORPORATION, AVIATION GAS TURBINE DIVISION.

HEAD OFFICE: LESTER BRANCH P.O., PHILADELPHIA 13, PENNSYLVANIA.

Division Manager: F. L. Snyder.

Manufacturing Manager: J. F. Chalupa.

Engineering Manager: R. P. Kroon.

Manager, Kansas City Plant: S. S. Stine.

Application Engineering Manager: R. Soucek.

The Westinghouse Electric Corporation began the development of aviation gas turbines in December, 1941, at the request of the U.S. Navy Bureau of Aeronautics.

The first Westinghouse jet engine, designated X19A, was the first turbojet engine in the United States to be developed exclusively from American design efforts. It was completed in March, 1943. The second X19A was test flown in January, 1944, as a booster unit mounted beneath the nose of a Chance Vought Corsair.

Outstanding among the several models produced by Westinghouse are the J30 and the J34 engines and their several variations. The production J30 engine formed the power-plant of the McDonnell FH-1 and before the engine was withdrawn from production in 1948, 261 were built. The production J34, an enlarged version of the J30, powers a number of U.S. Navy fighter aircraft including the McDonnell F2H and Douglas F3D.

A further improvement of the basic J34 Series, the J34-WE-34, successfully completed the most rigid jet-engine test specification required by the United States Military authorities. In 1950, the same engine was certificated by the U.S. Civil Aeronautics Authority for commercial aircraft applications.

The latest Westinghouse engine of which a brief mention is permitted is the J40, and there is also a J46, concerning which no details have yet been released. Both the J40 and J46 power certain naval prototype aircraft.

In 1953 an agreement was signed between Westinghouse and Rolls-Royce, Ltd., of Derby, England, under which the two companies will exchange technical information.

THE WESTINGHOUSE J40.

The J40 passed its 150-hour ground qualification tests early in 1951.

The J40 has a multi-stage axial compressor, a single annular combustion chamber with sixteen spray nozzles, a multi-stage turbine and a variable-area exhaust nozzle. An afterburner is fitted in the J40-WE-8.

The air inlet is of the bifurcated type and the major engine and aircraft accessories are mounted between the Y inlets. Thermal de-icing is provided.

The basic diameter of the J40 is approximately 40 in. (1,016 mm.) and with afterburner the engine weighs approximately 3,500 lb. (1,590 kg.).

All other information on this engine is classified but the accompanying illustrations disclose its external features.

THE WESTINGHOUSE J34.

TYPE.—Axial-flow Turbojet, with eleven-stage compressor and two-stage turbine.

COMPRESSOR.—Eleven-stage axial-flow. Compressor casing of aluminium-alloy. Compression ratio 3.65 : 1.

COMBUSTION CHAMBER.—Comprises a stainless-steel outer casing and stainless-steel concentrically-mounted double perforated liner. Fuel spray nozzle on outer and inner annulars. Fuel injected downstream.

FUEL SYSTEM.—Comprises a Holley pump and governor and matched emergency pump. Fuel supplied to manifold in two concentric fuel rings located at forward end of combustion chamber. Harsch fuel injection nozzles. Westinghouse automatic pump valve drains system on shut down. Fuel control is hydraulic and switch-over to emergency pump in event of failure of main pump is automatic.

FUEL GRADE.—Gasoline (AN-F-48).

NOZZLE GUIDE VANES.—Stationary vanes in turbine section are of cast vitalium.

TURBINE.—Two-stage. Discs of nickel steel alloy with stellite blades. Maximum turbine inlet temperature 1,425°F.

JET PIPE.—Stainless steel fixed inner cone and outer casing. Exhaust gas temperature 1,115°F. (military), 1,025°F. (normal).

LUBRICATION SYSTEM.—Dry sump. Nichols gear-type pump with one pressure and five scavenge units. Oil cooling by circulation through cylindrical cooler on front end of No. 1 bearing support. Main oil supply pressure 80 lb./sq. in. (5.6 kg./cm.^{2}).

STARTING.—Westinghouse 24-volt 10 h.p. direct-drive electric starter with 4 : 1 speed reducing gear train and 3-tooth driving jaw. Two Bendix ignition coils and two igniter plugs.

DIMENSIONS.—
Overall diameter 27 in. (685 mm.).
Nominal diameter 24 in. (610 mm.).
Length 120 in (3.050 mm.).
Frontal area 5.16 sq. ft. (0.297 m.^{2}).

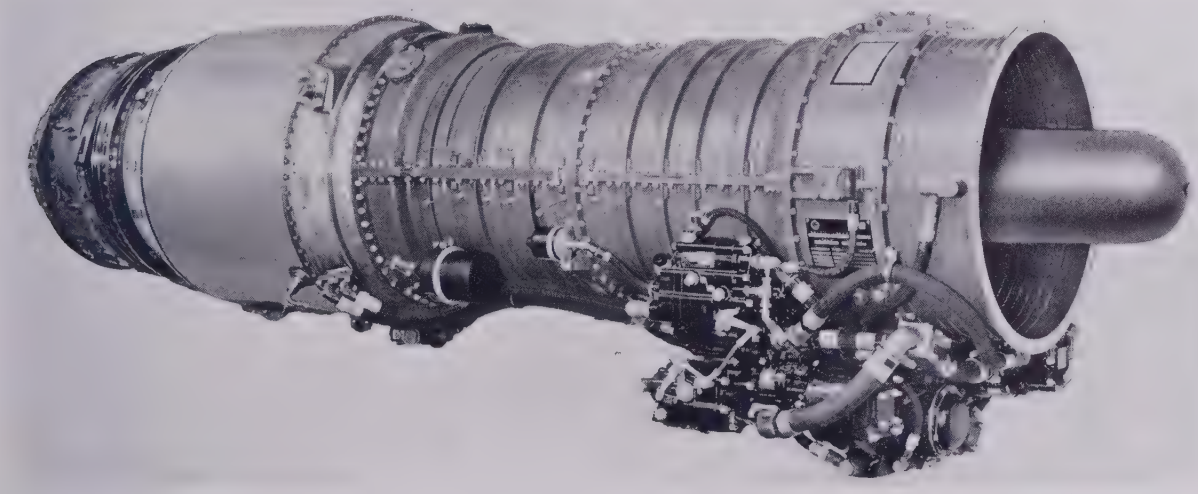
WEIGHT DRY J-34-W-22).—
1,200 lb. (545 kg.).

WEIGHT DRY (J-34-W-34).—
1,255 lb. (570 kg.).

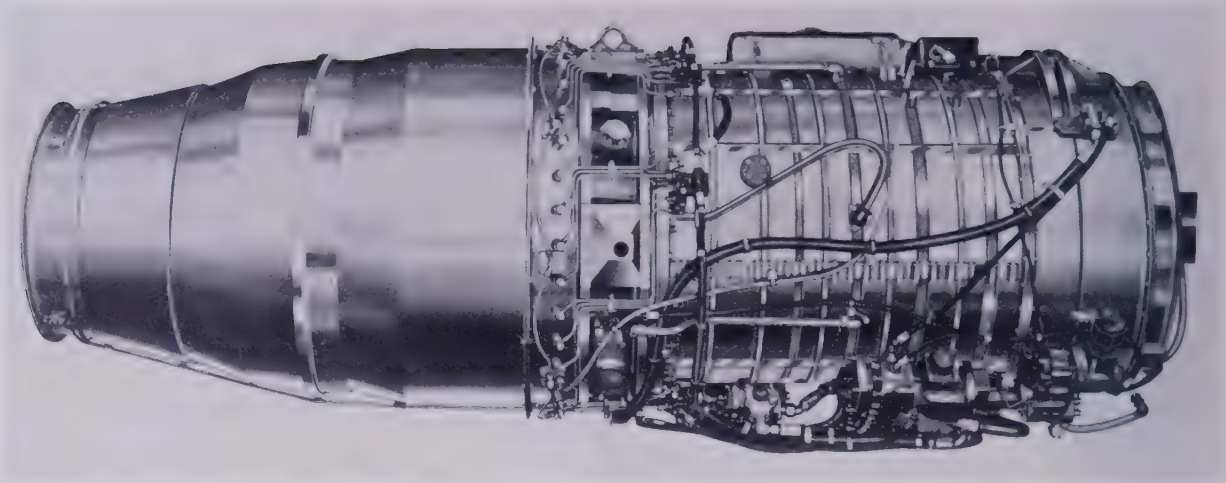
PERFORMANCE RATINGS (J34-W-22).—
Military (static) 3,000 lb. (1,362 kg.) at 12,500 r.p.m.
Normal (static) 2,290 lb. (1,040 kg.) at 11,500 r.p.m.

PERFORMANCE RATINGS (J34-W-34).—
Military (static) 3,250 lb. (1,475 kg.) at 12,500 r.p.m.
Normal (static) 2,650 lb. (1,203 kg.) at 10,500 r.p.m.

CONSUMPTIONS (Fuel).—
Military 1.08 lb./lb. thrust/hr. (1.08 kg./kg. thrust/hr.).
Normal 1.07 lb./lb. thrust/hr. (1.07 kg./kg. thrust/hr.).



The Westinghouse J34-WE-34 turbojet engine which has a thrust rating of 3,250 lb. (1,475 kg.).



The Wright J65 Sapphire turbojet engine which has a thrust rating of over 7,200 lb. (3,270 kg.).

WRIGHT AERONAUTICAL DIVISION, CURTISS-WRIGHT CORPORATION.

HEAD OFFICE AND WORKS: WOOD RIDGE, N.J.

Chairman of the Board and President: Roy T. Hurley.

Vice-President and General Manager: E. M. Powers.

Vice-President and Chief Engineer: W. G. Lundquist.

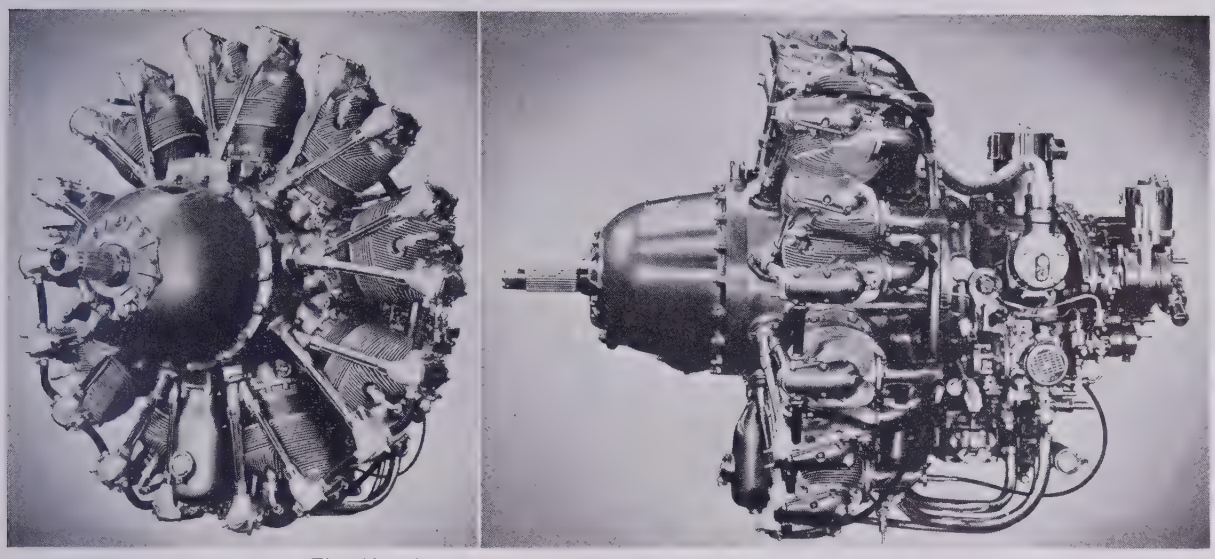
The Wright Aeronautical Division of Curtiss-Wright holds licences for the manufacture of the Armstrong Siddeley Sapphire (J65) and the Bristol Olympus (J67).

Production of the J65 Sapphire engine was begun in 1951. This engine is being installed in the Republic F-84F and RF-84F, the Martin B-57A Canberra, and the North American FJ-3. It is also earmarked for other advanced military aircraft. The J65 is still classified and the only information permitted to be published is that it has a static thrust rating of 7,200 lb. (3,270 kg.).

In addition to the development of a series of turbojet and turboprop engines, Wright is actively engaged in a ramjet development programme for guided missile applications.

PART 2—PISTON ENGINES
GREAT BRITAIN

ALVIS



The Alvis Leonides nine-cylinder radial air-cooled engine.

ALVIS LTD.

HEAD OFFICE AND WORKS: HOLYHEAD ROAD, COVENTRY.

Directors: J. J. Parkes, A.F.R.Ae.S. (Chairman and Managing Director), R. W. Rutledge (Deputy Chairman), S. W. Horsfield (Sales Director), H. J. Nixon (Works Director), Lieut.-Col. J. C. Chaytor and Capt. H. S. Harrison-Wallace, D.S.O., R.N. (Retd.).

The Alvis Company has several marks of its nine-cylinder Leonides radial engine in production for commercial and military aircraft, and is also engaged on the development of the fourteen-cylinder Leonides Major, which is scheduled to power the Bristol 173 twin-engined helicopter, the Westland Sikorsky S.55 helicopter, and the projected Handley Page H.P.R.3 four-engined medium airliner.

The present Leonides is the result of continuous development over many years, and the engine is the only modern piston engine in its class. The Leonides 503/6 (Mk. 126) is the standard power-plant for the Percival Provost, the new basic trainer for the Royal Air Force, and provides continuous power inverted.

The helicopter version of the Leonides is the standard power-plant for most British helicopters, and is now in large-scale service with the Royal Navy in the Westland Dragonfly, and with the Royal Australian Navy in the Bristol Sycamore.

THE ALVIS LEONIDES.

TYPE.—Nine-cylinder radial air-cooled, geared and supercharged.

CYLINDERS.—Bore 4.8 in. (122 mm.). Stroke 4.41 in. (112 mm.). Capacity 718.6 cub. in. (11.78 litres). Compression ratio 6.8 : 1. Nitrided steel barrels and cast Y-alloy heads screwed and shrunk on. Both barrels and heads have close-pitch fins. Cylinders attached to crankcase by studs.

PISTONS.—Forged Y-alloy with internal finning below crown. Two compression and two scraper rings, one scraper at skirt rest above gudgeon-pin. Fully-floating gudgeon-pins with washers and circlips.

CONNECTING RODS.—I-section master-rod and I-section auxiliary rods machined from high-grade steel. Master-rod has white metalled steel shell big-end bearing, all other bearings have bronze bushes.

CRANKSHAFT.—Alvis patent single-throw shaft with divided crank-pin. The divided pin is splined internally for a mating and splined steel coupling. Shaft runs in uncaged roller bearing and one ball thrust bearing.

CRANKCASE.—Cast in two halves in L.51 alloy.

VALVE GEAR.—Two inclined valves per cylinder with independent rocker system completely enclosed. Both valves of austenitic steel, the exhaust valve sodium-cooled and with "bright-ray" covered head and seats. Two-track cam disc, each track with four cams. Roller-type cam followers

ALVIS LEONIDES AND LEONIDES MAJOR RADIAL AIR-COOLED ENGINES.

Model	Bore and Stroke	Swept Volume	Take-off Power	International Rating	Max. Power Rating	Nett Dry Weight	Reduction Gear Ratio	Dimensions		Accessory Drives
								Diameter	Length	
Leonides 502/5	4.80 in. (122 mm.) × 4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	540/560 h.p.	450 h.p. at 7,000 ft. (2,135 m.)	570 h.p. at 1,750 ft. (533.5 m.)	796 lb. (361 kg.)	.625 to 1	41.5 in. (1,054 mm.)	52.8 in. (1,341 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
503/5 Mk. 25	4.80 in. (122 mm.) ×4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	540/560 h.p.	470 h.p. at 5,500 ft. (1,676 m.)	570 h.p. at 1,750 ft. (533.5 m.)	796 lb. (361 kg.)	.625 to 1	41.5 in. (1,054 mm.)	52.8 in. (1,341 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
503/6 Mk. 126	4.80 in. (122 mm.) ×4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	540/560 h.p.	470 h.p. at 5,500 ft. (1,676 m.)	570 h.p. at 1,750 ft. (533.5 m.)	805 lb. (365 kg.)	.625 to 1	41.5 in. (1,054 mm.)	5.28 in. (1,341 mm.)	Vacuum Pump. Fluid Pump. Air Compressor. Generator.
521/1 Mk. 50	4.80 in. (122 mm.) ×4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520 h.p.	460 h.p. at 7,250 ft. (2,210 m.)	535 h.p. at 3,250 ft. (1,022 m.)	790 lb. (358 kg.)	0.8 to 1 reverse rotation	41.5 in. (1,054 mm.)	55 in. (1,397 mm.)	Vertical Mounting. Vacuum Pump Fluid Pump. Generator.
523/1 Mk. 70	4.80 in. (122 mm.) ×4.41 in. (112 mm.).	718.6 cub. in. (11.78 litres).	540/560 h.p.	470 h.p. at 5,500 ft. (1,676 m.)	570 h.p. at 1,750 ft. (533.5 m.)	790 lb. (358 kg.)	0.8 to 1 reverse rotation	41.5 in. (1,054 mm.)	55 in. (1,397 mm.)	Vertical Mounting. Vacuum Pump. Fluid Pump. Generator.
524/1 Mk. 173	4.80 in. (122 mm.) ×4.41 in. (112 mm.)	718.6 cub. in. (11.78 litres)	520 h.p.	490 h.p. at 6,250 ft. (1,900 m.)	580 h.p. at 4,000 ft. (1,220 m.)	642 lb. (292 kg.)	nil	41.5 in. (1,054 mm.)	32.8 in. (833 mm.)	Vertical Mounting.
Leonides-Major A.LE.M.1-1	4.80 in. (122 mm.) ×4.41 in. (112 mm.)	117.8 cub. in. (18.34 litres)	870 h.p.	700 h.p. at 7,000 ft. (2,135 m.)	870 h.p. at S/L.	1,150 lb. (521 kg.)	.533 to 1	38.925 in. (988 mm.)	70.896 in. (1,800 mm.)	Vacuum Pump. Hydraulic Pump. Air Compressor. Generator and R.P.M. Generator.

positively lubricated and pressure oil passes up hollow push-rods to rockers.

CARBURATION.—Hobson Mk. 14 automatic low-pressure fuel injector. Induction system incorporates air-cleaning and de-frosting with oil-heated throttles and throttle housing.

SUPERCHARGER.—Atomised mixture fed into eye of impeller of centrifugal supercharger. Supercharger ratio 6.5 : 1.

FUEL.—Grade 100/130 (D.E.R.D.2485).

IGNITION.—Two B.T.H. type C.2SE.9S or C.9B/2 magnetos with fully screened ignition system. Two plugs per cylinder.

LUBRICATION.—Dry sump system. One pressure pump and two scavenge pumps in tandem. Normal oil pressure 60-80 lb./sq. in. (4.2-5.6 kg./cm.²). Inlet temperature (max.) 85°C. Outlet temperature (max.) 110°C. Normal oil flow 300 gallons (1,364 litres) per hour.

REDUCTION GEAR.—Farman type epicyclic. Gear ratio 0.625 : 1.

AIRSCREW SHAFT.—No. 3 size L.H. rotation. Constant-speed governor unit driven through bevels mounted on front of cam gearing drive-shaft. Operating oil passes through annular channels and drilling in special oil transfer unit located inside stationary bevel of reduction gear.

MOUNTING.—Dynafocal flexible type with four pin-jointed attachments.

COOLING.—Complete pressure baffling and flexibly-mounted close-fitting cowling with hinged panels and electrically-operated gills.

STARTING.—Rotax type C.0251 hand/electric starter, or with feathering pump drive.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

CONSUMPTIONS.—

Fuel (at max. continuous power) 39.25 Imp. gal. (178.5 litres) per hour.

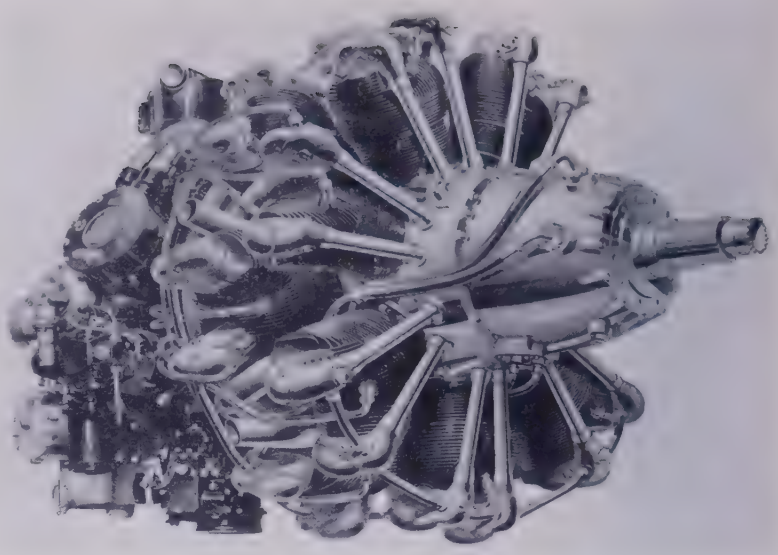
Oil 4 to 9 pints (2.2 to 5.1 litres) per hour.

THE ALVIS LEONIDES MAJOR.

TYPE.—Fourteen cylinder two-row air-cooled radial, geared and supercharged.

CYLINDERS.—Same as for Leonides. Swept volume 1,117.8 cub. in. (18.34 litres).

PISTONS AND CONNECTING RODS.—Same as for Leonides.



The 870 h.p. Alvis Leonides Major two-row radial engine.

CRANKSHAFT.—Two-throw three-piece shaft running in three roller bearings.

CRANKCASE.—Three-piece case.

VALVE-GEAR.—Same as for Leonides.

INDUCTION.—Hobson Mk. 122 automatic fuel injector.

SUPERCHARGER.—Centrifugal. Supercharger ratio 6.5 : 1.

FUEL GRADE.—100/130 (D.E.R.D.2485).

IGNITION.—Two Rotax N.14A magnetos mounted on rear cover. Two Lodge LA 1/1 plugs per cylinder. Plessey fully-screened ignition harness.

LUBRICATION.—Dry sump. One pressure pump, two scavenge pumps in tandem.

REDUCTION GEAR.—Epicyclic with fixed bevel and six satellite pinions. Ratio .533 : 1.

AIRSCREW SHAFT.—No. 4 size L.H. rotation. Other details as for Leonides.

ACCESSORIES.—Provision for all normal accessories, all on rear cover, with direct gear drive.

STARTING.—Rotax hand-electric or Plessey cartridge type.

MOUNTING.—Dynafocal mounting with four pick-up points.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

CONSUMPTIONS.—

Fuel (at max. continuous power) 57 gal. (259 litres) per hour.

Oil 6 to 10 pints (3.4 to 5.7 litres) per hour.

BRISTOL

THE BRISTOL AEROPLANE CO., LTD.

HEAD OFFICE, WORKS AND AERODROME: FILTON, BRISTOL.

LONDON OFFICE: 6, ARLINGTON STREET, ST. JAMES'S, LONDON, S.W.1.

Directors: Sir William G. Verdon Smith, C.B.E., J.P. (Chairman), Sir G. Stanley White, Bt. (Deputy Chairman), Sir Reginald Verdon Smith, M.A., B.C.L., J.P. and G. S. M. White (Joint Managing Directors), Capt. K. J. G. Bartlett, C.B.E., A.F.R.Ae.S., M.Inst.T., M.S.A.E. (Sales Director), Sir W. Alec Coryton, K.C.B., K.B.E., M.V.O., D.F.C. (Managing Director, Engine Division), B. Davidson (Commercial Director), W. Masterton (Financial Director), Dr. A. E. Russell, D.Sc., F.R.Ae.S., F.I.Ae.S. (Chief Engineer, Aircraft Division), C. F. Uwins, O.B.E., A.F.C., F.R.Ae.S. (Managing Director, Aircraft Division).

Secretary: J. F. Harper, C.A.

Engine Division Board: Sir Reginald Verdon Smith, M.A., B.C.L., J.P. (Chairman), Sir W. Alec Coryton, K.C.B., K.B.E., M.V.O., D.F.C. (Managing Director), B. Davidson, Dr. S. G. Hooker, O.B.E., D.Phil., D.I.C., F.R.Ae.S. (Chief Engineer), J. Innes, C.B.E., M.A., R. L. Ninnes, F.R.Ae.S., F. W. Whitehead, M.I.Mech.E., A.F.R.Ae.S., M.I.P.E., G. W. Wright, A.R.Ae.S., M.I.P.E.

Secretary: J. Pickles.

The Bristol Aeroplane Co., Ltd. was originally founded in 1910 but it did not enter the aero-engine field until 1920, when an Aero-engine Department was established to design and manufacture radial air-cooled engines.

Its first engine was the famous Jupiter nine-cylinder radial, which was followed in 1927 by the Mercury and in 1932 by the Pegasus. The Mercury, developed for fighter aircraft, was similar to the supercharged Jupiter but was fitted with a reduction gear and had a shorter stroke. It was the first British aero-engine to be approved for controllable-pitch airscrews.

The development of sleeve-valve engines was undertaken by the company in 1926. By 1932 the first engine—the Perseus—a nine-cylinder radial of the same bore and stroke as the Mercury, was running satisfactorily on test. By the end of 1936, the Hercules—a fourteen-cylinder two-row radial sleeve-valve engine—had passed its first civil type test. Experience with these engines prompted the design of the Centaurus, an eighteen-cylinder engine, in many respects similar to the Hercules, but having a longer stroke.

During the last war the Bristol company and its shadow factories produced over 100,000 engines, of which 57,400 were Hercules and 2,500 were Centaurus engines.

The first post-war range of Bristol civil engines were in the Hercules 630 Series. These engines were essentially similar to the military Hercules 100 Series except that they had single-speed superchargers. These were followed by the more powerful Hercules 230, 730, 750, 760 and 770 Series and Centaurus 660 Series. These engines incorporated many new features, such as copper-based cylinder-heads giving improved cooling, improved two-speed supercharger drive, larger bearings, high-powered drives for accessories, and in the case of the Centaurus a front ignition system. All have been stiffened to permit development well in excess of their present ratings.

Hercules 100 Series engines power the Handley Page Hastings transport now in service in the R.A.F. The Hercules 630 Series is used in the Short Solent flying-boat and in the Vickers Viking and Bristol Type 170. The approved overhaul period for these engines now stands at 1,250 hours.

The Hercules 230 powers the Vickers Valetta military transport, and civil versions of this engine, of the 730 Series, are used in current types of Bristol Freighters, the French Nord 2501 Noratlas and the Solent 4 flying-boats of Tasman Empire Airways. Hastings transports of the Royal New Zealand Air Force also use this series of engine, which develops over 2,000 h.p. for take-off on 100/130 grade fuel.

The Hercules 763 is in service with B.O.A.C. in the Handley Page Hermes 4 airliner, and delivers 2,100 h.p. on 115/145 grade fuel. A modified version, the Hermes 4A, uses Hercules 773 engines rated on 100/130 grade fuel with methanol-water injection for take-off. A military version of this series of engines, the Hercules 264, is used in the Vickers Varsity.

Centaurus 18 engines continue to be used all over the world in Hawker Sea Fury fighters. The Centaurus 57 is in service in the Bristol Brigand. The more recent Centaurus 660 series is employed in the de Havilland Ambassador airliners, operated by B.E.A. A military version, the Centaurus 173, is in production for the Blackburn Beverley heavy freighter for the R.A.F., and develops 2,850 h.p. for take-off on 100/130 grade fuel with methanol-water injection.

Details of Bristol gas-turbine engines will be found in Part I of this Section.

THE BRISTOL CENTAURUS.

The latest marks of Centaurus civil engines are of the 660 series and have two-speed superchargers. They are fitted with the new Bristol copper-based cylinder head, and embody the necessary drive and face for an airscrew reversing pump, together with a 150 h.p. accessory drive.

The Centaurus 18 for the Hawker Sea Fury and the 57 for the Bristol Brigand differ in reduction-gear ratio and type of engine-mounting. In addition the 57

has provision for methanol-water injection giving 2,800 b.h.p. for take-off.

The following are the principal versions of the Centaurus :—

Centaurus 18. Twin-entry two-speed supercharger engine, with O.44 reduction gear ratio and flexible engine-mounting. Vertically-mounted starter.

Centaurus 57. Twin-entry two-speed supercharger engine, with O.40 reduction gear ratio and rigid engine-mounting. Vertically-mounted starter and provision for methanol-water injection.

Centaurus 660 Series. Twin-entry two-speed supercharged engines having dynamic flexible mountings, copper-based cylinder-heads, etc.

The description which follows refers to the 660 Series.

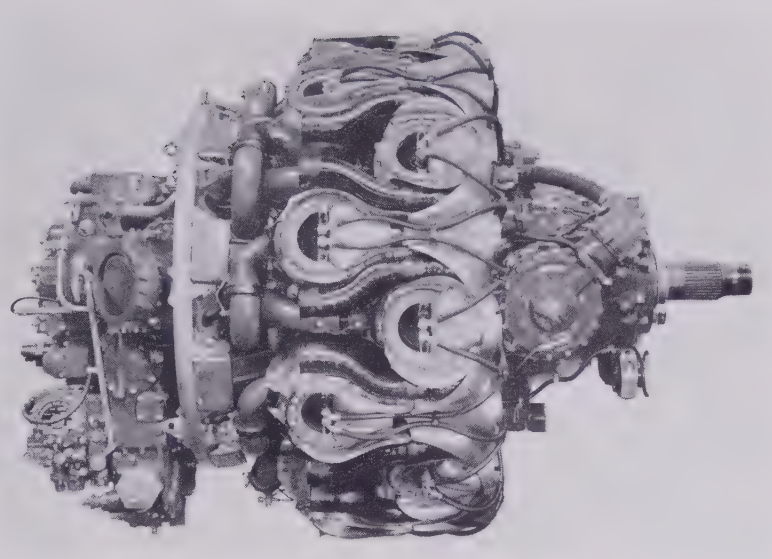
TYPE.—Eighteen-cylinder two-row air-cooled sleeve-valve radial with two-speed supercharger.

CYLINDER ASSEMBLY.—Bore 5.75 in. (146 mm.). Stroke 7 in. (178 mm.). Swept volume 3,270 cub. in. (53.6 litres). Open ended light alloy barrels with deep closely pitched fins, machined from solid. Cylinder heads of latest fabricated pattern with finned copper base and steel body.

SLEEVE DRIVE.—By simple spur gear trains from front and rear ends of crankshaft, driving short cranks for the front and rear banks respectively. Each sleeve crank is carried at one end in a plain bearing in the crankcase, and at the other end in a plain bearing in the enclosing casing, through which pressure oil is supplied for the sleeve ball assemblies. The cranks run at one half engine speed. Intermediate gears are carried on needle roller-bearings.

PISTONS.—Fully skirted type, with two wedge-section gas rings and a scraper ring above the gudgeon-pin and one bevelled scraper ring in the skirt. Fully-floating gudgeon-pins in pistons and small ends of connecting-rods.

CONNECTING RODS.—Front and rear assemblies each comprising a master-rod, bearing directly on the white metalled crankpin sleeve, and eight articulated rods carried in the master-rod.



The 2,625 h.p. Bristol Centaurus 661 sleeve-valve radial engine.

CRANKSHAFT.—Three-piece built-up type carried in four roller main bearings. Crankpins formed integral with centre-section, and fitted with white-metalled steel sleeves for big-end bearings.

CRANKCASE.—In three sections, carrying housing for the main bearings and sleeve crank bearings.

FRONT COVER.—Encloses the front bank sleeve-drive mechanism and has flanges and drives for the constant-speed unit, airscrew reversing pump and ignition distributors. There is a small oil pump in the base of the casting to return surplus oil from the front of the engine to the sump.

SUPERCHARGER AND INDUCTION SYSTEM.—Two-speed centrifugal supercharger, housed in a light-alloy casing. The aluminium-alloy impeller is of the double-shrouded type, and has a guide vane rotor mounted with it as an integral unit on the hollow alloy-steel impeller shaft. The drive to the impeller shaft is taken from the rear of the crankshaft through compound epicyclic spur gear trains. Gear changing is by stationary hydraulic clutches, which have the effect of changing the "sun" wheel of the epicyclic trains, to give the two-gear ratios. A vaned diffuser ring encircling the impeller passes the compressed mixture to the annular diffuser chamber formed in the supercharger casing, whence eighteen aluminium-alloy induction pipes lead to the cylinders. The supercharger casing incorporates drives and faces for engine accessories, including the ignition generators, the fuel-pump and the electric starter. The engine rear cover is replaced by a simple plate which encloses the rear of the supercharger, and provides a bearing for the 150 h.p. accessory drive.

BRISTOL CENTAURUS SLEEVE-VALVE RADIAL ENGINES.

	Bore and Stroke	Capacity	Airscrew Gear Ratio	Diameter	Weight (dry)	Take-off Power	Maximum Power for all-out level flight for 5 mins.	Normal Climb	Maximum Economical Cruising	Fuel Grade
CENTAURUS 18 and 57 (Military)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	Mk. 18 0.444 : 1 Mk. 57 .400 : 1	55.3 in. (1.405 m.)	Mk. 18 2,920 lb. (1,324 kg.) Mk. 57 2,830 lb. (1,284 kg.)	2,470 h.p. at 2,700 r.p.m. Mk. 57 with methanol water 2,810 h.p.	2,550 h.p. at 2,700 r.p.m. at 4,000 ft. (1,219 m.) and 2,280 h.p. at 2,700 r.p.m. at 16,500 ft. (5,031 m.)	2,160 h.p. at 2,400 r.p.m. at 5,000 ft. (1,524 m.) and 1,975 h.p. at 2,400 r.p.m. at 15,750 ft. (4,800 m.)	1,745 h.p. at 2,400 r.p.m. at 11,000 ft. (3,353 m.) and 1,600 h.p. at 2,400 r.p.m. at 21,250 ft. (6,477 m.)	100/130
CENTAURUS 660 and 661 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.400 : 1	57.75 in. (1.463 m.)	Mk. 660 3,375 lb. (1,530 kg.) Mk. 661 3,410 lb. (1,546 kg.)	2,625 h.p. at 2,800 r.p.m.	2,705 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.)	2,265 h.p. at 2,500 r.p.m. at 5,000 ft. (1,675 m.) and 2,110 h.p. at 2,500 r.p.m. at 12,000 ft. (3,660 m.)	1,675 h.p. at 2,500 r.p.m. at 11,500 ft. (2,760 m.) and 1,575 h.p. at 2,500 r.p.m. at 17,500 ft. (5,335 m.)	100/130
CENTAURUS 662 and 663 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.400 : 1	57.75 in. (1.463 m.)	Mk. 662 3,585 lb. (1,626 kg.) Mk. 663 3,620 lb. (1,642 kg.)	2,625 h.p. at 2,800 r.p.m. or with methanol water 2,850 h.p. at 2,800 r.p.m.	2,705 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.)	2,265 h.p. at 2,500 r.p.m. at 5,000 ft. (1,675 m.) and 2,110 h.p. at 2,500 r.p.m. at 12,000 ft. (3,660 m.)	1,675 h.p. at 2,500 r.p.m. at 11,500 ft. (2,760 m.) and 1,575 h.p. at 2,500 r.p.m. at 17,500 ft. (5,335 m.)	100/130
CENTAURUS 173 (Military) and 673 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.400 : 1	60.5 in. (1.49 m.)	3,350 lb. (1,519 kg.)	2,625 h.p. at 2,800 r.p.m. or with methanol water 2,850 h.p. at 2,800 r.p.m.	2,730 h.p. at 2,800 r.p.m. at 5,250 ft. (1,599 m.)	2,390 h.p. at 2,500 r.p.m. at 4,500 ft. (1,371 m.)	1,720 h.p. at 2,400 r.p.m. at 11,500 ft. (2,760 m.)	100/130

Fuel System.—A Hobson-R.A.E. injector is fitted, supplying two spray nozzles, one in each intake trunk. The fuel pump is an integral part of the injector and is driven from a gear train in the supercharger casing.

Ignition System.—Twin L.T. generators mounted at the rear of the engine supply twin H.T. transformers and distributors on the front cover. Two plugs in each cylinder are separately supplied by each distributor through leads enclosed in a waterproof screened harness.

Lubrication System.—Direct pressure lubrication from oil pump in the sump through hollow main driving shaft and crankshaft to supply pressure oil to the supercharger, big end bearings and reduction gear. Separate pressure lines delivering oil to the sleeve driving mechanism. Pistons and sleeve splash-lubricated and supplemented by oil jets in the crankshaft. Oil in sump returned to tank by scavenge pump which is integral with pressure pump.

Reduction Gear.—Epicyclic bevel type with a ratio of 0.40 : 1. The gears are located by spherical seats, spreading the load evenly over the three bevel pinions. Rear bevel wheel is driven from the crankshaft through a toothed coupling. All engines bearing an odd type number (*e.g.* Centaurus 661, etc.) have a torquemeter built integral with the reduction gear.

Dimensions, Weights and Performance.—See Table.

THE BRISTOL HERCULES.

The Hercules is by far the most widely used of the Bristol sleeve-valve engines. There are many types, which divide into the following groups :—

Hercules 100 Series. Military series. Two-speed supercharger, two-piece aluminium-alloy cylinder head.

Hercules 630 and 670 Series. Single-speed supercharged civil versions of the Hercules 100.

Hercules 230 Series. Single-speed supercharger, copper-based cylinder heads and stiffened power section, for military applications.

Hercules 730 Series. Civil version of Hercules 230 Series.

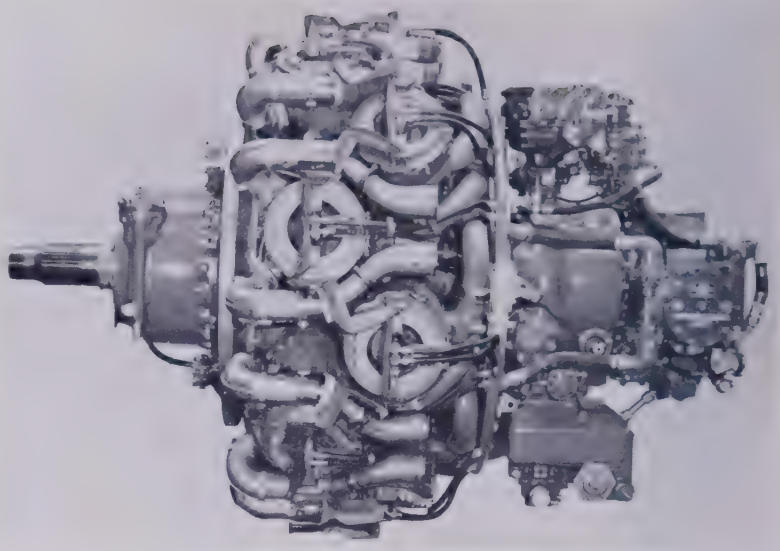
Hercules 750 Series. Similar to Hercules 730 Series, but with provision for reversing propellers and 30 h.p. accessory drive. The Hercules 758 is being built under licence in France by S.N.E.C.M.A.

Hercules 760 Series. Two-speed supercharged civil engine, with copper-based cylinder heads, provision for reversing propellers and 150 h.p. accessory drive. Rated on 115/145 grade fuel.

Hercules 770 Series. Similar to Hercules 760, but rated on 100/130 Grade fuel, and with methanol/water injection for take-off. Supercharger locked in low gear.

Hercules 260 Series. Military version of Hercules 760 Series.

The description which follows refers to the Hercules 763.



The 2,080 h.p. Bristol Hercules 763 sleeve-valve radial engine.

Type.—Fourteen-cylinder two-row air-cooled sleeve-valve radial with two-speed supercharger.

Cylinder Assembly.—Bore 5¾in. (146 mm.). Stroke 6½ in. (165 mm.). Swept volume 2,360 cub. in. (38.7 litres). Open-ended light alloy barrels with deep closely-pitched fins, machined from solid. Cylinder heads have finned copper bases and steel bodies.

Sleeve Drive.—By simple spur gear trains from the front end of the crankshaft, driving short cranks for the sleeves of the front bank and long cranks for the rear bank. Each sleeve crank is carried at one end in a roller bearing in the crankcase, and at the other end in a plain bearing in the front cover, through which pressure oil is supplied for the sleeve ball assemblies. The cranks run at one half engine speed and the intermediate gears are carried on needle roller-bearings.

Pistons.—Fully-skirted type, with two wedge-section gas rings and a scraper ring above the gudgeon-pin and one bevelled scraper ring in the skirt. Gudgeon-pins fully-floating in pistons and small ends of connecting-rods.

Connecting Rods.—Front and rear assemblies each comprising a master-rod, bearing directly on the white-metalled crankpin sleeve and six articulated rods carried in the master rod.

Crankshaft.—Three-piece built-up type carried in four roller main bearings. Crankpins formed integral with centre section and fitted with white-metalled steel sleeves for big-end bearings.

Crankcase.—In three sections, carrying housings for the main bearings and sleeve crank bearings.

Front Cover.—Encloses the sleeve drive mechanism and has flanges and drives for the constant-speed unit and airscrew reversing pump. There is a small oil pump in the base of the casting to return surplus oil from the front of the engine to the sump.

Supercharger.—Two-speed supercharger with stationary hydraulic clutches and epicyclic driving trains. Single down-shaft intake and double-shrouded aluminium-alloy impeller. Individual induction pipes to all cylinders with screwed joints.

Rear Cover.—Carries the essential engine accessories, magnetos, starter and fuel pump, and embodies a high-powered accessory drive (150 h.p. max.) for cabin superchargers, etc.

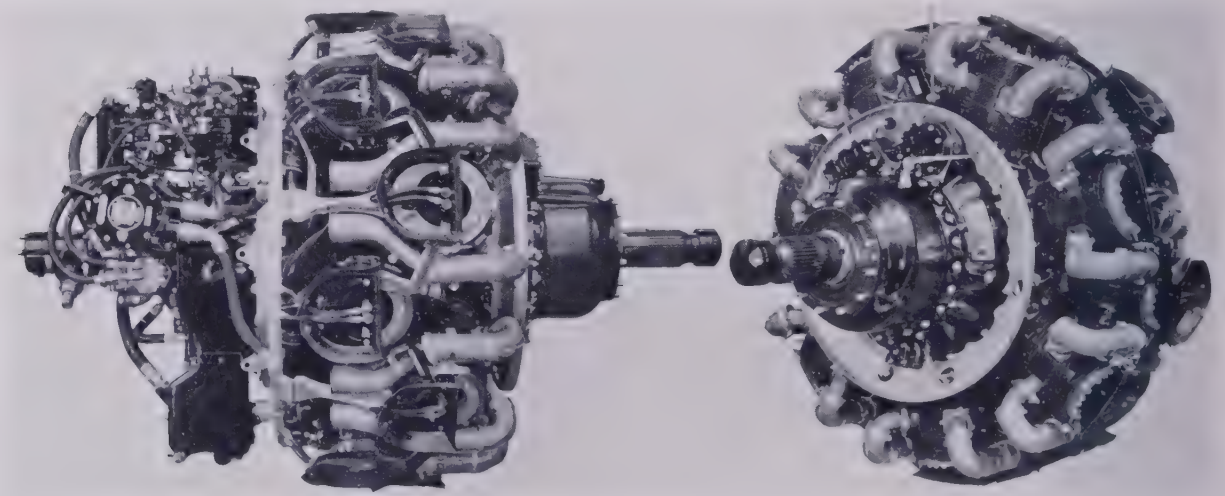
Fuel System.—A Hobson-R.A.E. injector is fitted as standard.

Ignition System.—Two magnetos supply separately two plugs per cylinder. Waterproof and fully-screened ignition harness.

Lubrication System.—Direct pressure lubrication from oil pump in the sump through hollow main driving shaft and crankshaft, to supercharger, big end bearings and reduction gear. Separate pressure lines deliver oil to sleeve driving mechanism. Pistons and sleeves splash lubricated and supplemented by oil jets in the crankshaft. Oil in sump returned to tank by scavenge pump which is integral with pressure pump.

Reduction Gear.—Epicyclic bevel type with a ratio of 0.44 : 1. The front and rear bevels are located by spherical seats, spreading the load evenly over the three bevel pinions. Rear bevel wheel is driven from the crankshaft through a toothed coupling. Large diameter internal oil passages and oil transfer system ensure rapid propeller reversing. Torquemeter built integral with the reduction gear.

Dimensions, Weight and Performance.—See Table.



The 2,040 h.p. Bristol Hercules 758 sleeve-valve radial engine.

BRISTOL HERCULES SLEEVE-VALVE RADIAL ENGINES.

	Bore and Stroke	Capacity	Air-screw Gear Ratio	Diameter	Weight (dry)	Take-off Power	Maximum Power for all-out level flight for 5 mins.	Normal Climb	Maximum Economical Cruising	Fuel Grade
HERCULES 101 (Military)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,090 lb. (948 kg.)	1,640 h.p. at 2,800 r.p.m.	1,765 h.p. at 2,800 r.p.m. at 9,250 ft. (2,819 m.) and 1,590 h.p. at 2,800 r.p.m. at 19,500 ft. (5,943 m.)	1,475 h.p. at 2,400 r.p.m. at 8,000 ft. (2,438 m.) and 1,360 h.p. at 2,400 r.p.m. at 16,500 ft. (5,031 m.)	1,240 h.p. at 2,400 r.p.m. at 13,250 ft. (4,038 m.) and 1,165 h.p. at 2,400 r.p.m. at 21,500 ft. (6,553 m.)	100/130
HERCULES 106 (Military)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2,090 lb. (948 kg.)	1,675 h.p. at 2,800 r.p.m.	1,775 h.p. at 2,800 r.p.m. at 7,250 ft. (2,210 m.) and 1,595 h.p. at 2,800 r.p.m. at 17,500 ft. (5,336 m.)	1,360 h.p. at 2,400 r.p.m. at 8,000 ft. (2,438 m.) and 1,280 h.p. at 2,400 r.p.m. at 16,500 ft. (5,031 m.)	1,115 h.p. at 2,400 r.p.m. at 13,250 ft. (4,040 m.) and 1,050 h.p. at 2,400 r.p.m. at 21,500 ft. (6,557 m.)	100/130
HERCULES 634 and 638 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mk. 634 1,945 lb. (882 kg.) Mk. 638 1,955 lb. (886 kg.)	1,690 h.p. at 2,800 r.p.m.	1,780 h.p. at 2,800 r.p.m. at 6,500 ft. (1,981 m.)	1,510 h.p. at 2,400 r.p.m. at 3,750 ft. (1,143 m.)	1,315 h.p. at 2,400 r.p.m. at 8,250 ft. (2,514 m.)	100/130
HERCULES 637 and 672 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mk. 637 1,980 lb. (898 kg.) Mk. 672 1,960 lb. (889 kg.)	1,690 h.p. at 2,800 r.p.m.	1,780 h.p. at 2,800 r.p.m. at 6,500 ft. (1,981 m.)	1,590 h.p. at 2,500 r.p.m. at 5,250 ft. (1,600 m.)	1,320 h.p. at 2,400 r.p.m. at 8,500 ft. (2,590 m.)	100/130
HERCULES 230 (Military)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2.095 lb. (950 kg.)	1,925 h.p. at 2,800 r.p.m.	2,000 h.p. at 2,800 r.p.m. at 5,000 ft. (1,524 m.)	1,650 h.p. at 2,400 r.p.m. at 3,250 ft. (990 m.)	1,270 h.p. at 2,400 r.p.m. at 10,250 ft. (3,124 m.)	100/130
HERCULES 234 (Military) and 734 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 in.)	Mks. 234, 734 2,100 lb. (953 kg.) Mks. 235, 735 2,145 lb. (973 kg.)	1,980 h.p. at 2,800 r.p.m.	2,020 h.p. at 2,800 r.p.m. at 2,750 ft. (838 m.)	1,660 h.p. at 2,500 r.p.m. at 4,500 ft. (1,372 m.)	1,220 h.p. at 2,400 r.p.m. at 10,500 ft. (3,200 m.)	100/130
HERCULES 733, 737, 738, 758, 759 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mks. 733, 737, 2,140 lb. (970 kg.) Mks. 738 2,105 lb. (954 kg.) Mk. 758 2,165 lb. (982 kg.) Mk. 759 2,190 lb. (993 kg.)	2,040 h.p. at 2,800 r.p.m.	2,090 h.p. at 2,800 r.p.m. at 3,000 ft. (914 m.)	1,670 h.p. at 2,500 r.p.m. at 5,000 ft. (1,524 m.)	1,215 h.p. at 2,400 r.p.m. at 10,750 ft. (3,276 m.)	100/130
HERCULES 762 and 763 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mk. 762 2,370 lb. (1,075 kg.) Mk. 763 2,395 lb. (1,086 kg.)	2,080 h.p. at 2,900 r.p.m.	2,140 h.p. at 2,900 r.p.m. at 3,750 ft. (1,143 m.)	1,655 h.p. at 2,500 r.p.m. at 5,750 ft. (1,753 m.) and 1,535 h.p. at 2,500 r.p.m. at 16,500 ft. (5,031 m.)	1,220 h.p. at 2,400 r.p.m. at 12,500 ft. (3,810 m.) and 1,135 h.p. at 2,400 r.p.m. at 22,250 ft. (6,782 m.)	115/145
HERCULES 772 and 773 (Civil)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	Mk. 772 2,370 lb. (1,075 kg.) Mk. 773 2,395 lb. (1,086 kg.)	1,965 h.p. at 2,800 r.p.m. with Methanol water 2,125 h.p. at 2,900 r.p.m.	1,985 h.p. at 2,800 r.p.m. at 1,500 ft. (457 m.)	1,635 h.p. at 2,500 r.p.m. at 2,750 ft. (938 m.)	1,160 h.p. at 2,400 r.p.m. at 9,750 ft. (2,970 m.)	100/130
HERCULES 264 (Military)	5¾ in. × 6½ in. (146 mm. × 165 mm.)	2,360 cub. in. (38.7 litres)	0.444 : 1	52 in. (1.32 m.)	2.305 lb. (1,045 kg.)	1,950 h.p. at 2,800 r.p.m.	1,990 h.p. at 2,400 r.p.m. at 2,750 ft. (837 m.)	1,605 h.p. at 2,400 r.p.m. at 2,750 ft. (837 m.) and 1,535 h.p. at 2,400 r.p.m. at 11,000 ft. (3,353 m.)	1,125 h.p. at 2,400 r.p.m. at 11,750 ft. (3,572 m.) and 1,065 h.p. at 2,400 r.p.m. at 19,500 ft. (1,640 m.)	100/130

CIRRUS

THE CIRRUS ENGINE DIVISION OF BLACKBURN AND GENERAL AIRCRAFT LTD.

HEAD OFFICE AND WORKS: ENGINE DEPT., BROUGH, E. YORKS.

LONDON OFFICE: 43, BERKELEY SQUARE, LONDON, W.1.

Directors: R. Blackburn, O.B.E., A.M.I.C.E., M.I.Mech.E., F.R.Ae.S. (Chairman), E. Turner, A.C.A. (Managing Director), Major F. A. Bumpus, B.Sc., A.R.C.S., Wh.Sc., F.R.Ae.S., N. E. Rowe, C.B.E., B.Sc., M.I.Mech.E., Whit.Ex., F.R.Ae.S., Sir Maurice Bonham Carter, K.C.B. K.C.V.O., W. A. Hargreaves, M.B.E., A.M.I.C.E., F.R.Ae.S. and Air Vice-Marshal H. N. Thornton, C.B.E.

Chief Designer: F. R. Bell.

Sales Manager: Group-Capt. H. J. Wilson, C.B.E., A.F.C.

The Cirrus aero-engine, the pioneer light four-cylinder in-line air-cooled engine, made possible the light aeroplane of to-day, and its long list of successes in light aircraft of many types dates back to 1925. It is true to say that the light aeroplane movement was founded on the Cirrus engine which is now so widely known throughout the World that it needs no further introduction.

During post-war years the Cirrus Engine Division has been developing direct petrol injection engines and the first of these to be completed and to pass the British Air Registration Board approval tests is the Bombardier, which is described below.

The British manufacturing rights for Turboméca gas-turbine engines were acquired in October, 1952. Details of these units will be found under Turboméca (France) in Part I of this Section.

THE CIRRUS BOMBARDIER 702.

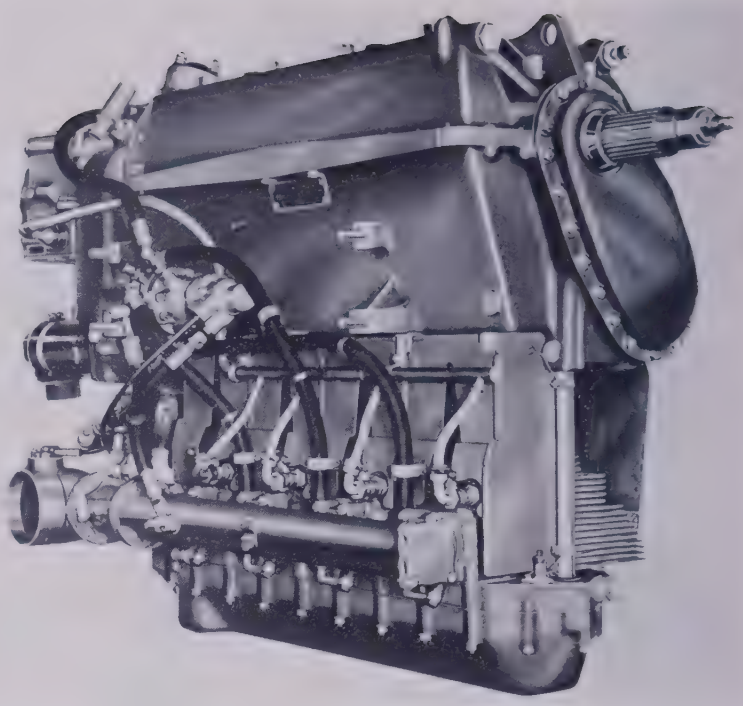
The Bombardier has been designed primarily for use with a constant-speed airscrew but can, if required, be used with a fixed-pitch airscrew.

The engine is fitted with fuel-injection equipment and will be suitable for use with safety fuels when these become available.

TYPE.—Four-cylinder in-line inverted air-cooled.

CYLINDERS.—Bore 4.8 in. (121.92 mm.). Stroke 5.5 in. (139.7 mm.). Capacity 398.12 cub. in. (6.524 litres). Compression ratio 7 : 1. High carbon steel barrels machined from solid, with Y-alloy pent-roof type head screwed on. Cylinders attached to crankcase by eight studs and nuts. Each cylinder head carries two plug adaptors, a nickel-chrome manganese steel inlet valve seat, a high nickel-chrome steel exhaust valve seat, and an adaptor for fuel injector nozzle.

PISTONS.—Aluminium-alloy. Two compression and one scraper ring. Fully-floating gudgeon-pins secured by washers and circlips.



The 180 h.p. Cirrus Bombardier 702 engine.

CONNECTING RODS.—H-section aluminium-alloy forgings with copper-lead steel-backed big-end bearings.

CRANKSHAFT.—Nickel-chrome molybdenum steel forging in five bearings. Pressure oil is carried to the big-end bearings *via* copper tubes which connect the journal and crankpin bores. Front end of shaft embodies a double flange to take thrust.

CRANKCASE.—Magnesium-alloy castings, comprising front cover, main case, top cover and rear cover. Main case houses lower halves of main bearings, and thrust bearing. Top cover houses upper halves of bearings and also carries the front lifting eye.

VALVE GEAR.—One inlet and one exhaust valve per cylinder. Camshaft carried in carrier plate and driven by vertical shaft through bevel gears. Valve operating gear enclosed in cover which acts as oil bath for valve gear and sump from which oil is scavenged.

IGNITION.—B.T.H. Duplex magneto. Fully-screened ignition harness.

FUEL SYSTEM.—Two Amal type 240 booster pumps driven by vertical drive shaft supply fuel through filter to S.U. injector pump operating from main gear train and metering fuel to nozzles. Injector pump strokes governed by hydraulic servo mechanism automatically controlled by capsule chamber sensitive to manifold depression, air intake temperature and altitude.

FUEL.—91/98 Octane minimum.

LUBRICATION.—One pressure pump and duplex scavenge pump.

ACCESSORIES.—Pesco vacuum pump. Hymatic compressor. Rotax B.1815 24-volt generator. A Lockheed hydraulic pump may be fitted in place of compressor. Drives are also included for S.U. fuel injection pump. B.T.H. magneto, pressure oil pump, tachometer and Rotol C.S. unit.

AIRSCREW.—Rotol constant-speed, or fixed-pitch. Left-hand tractor.

STARTING.—Rotax 24-volt electric (direct cranking).

COOLING.—Air scoop and cylinder baffles supplied with engine.

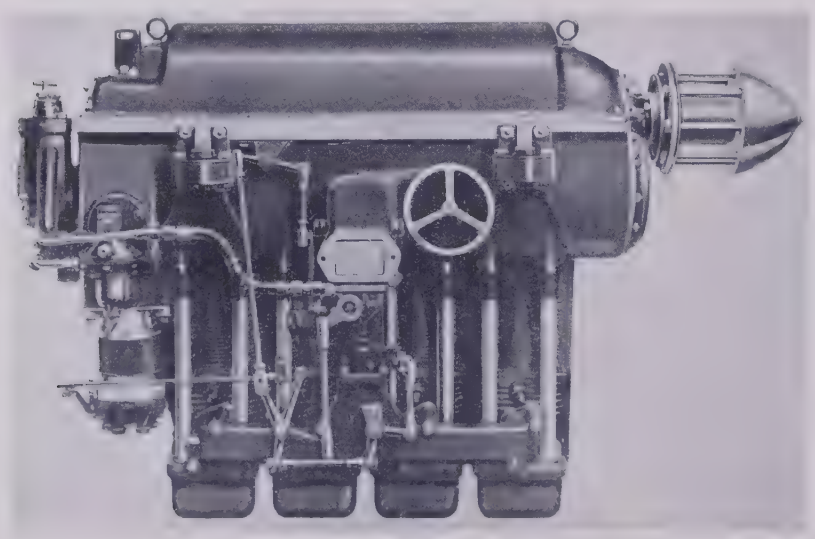
DIMENSIONS.—
Length overall 45.3 in. (1,152 mm.).
Height 30.95 in. (786 mm.).
Width 19 in. (483 mm.).

NET DRY WEIGHT.
Including fuel pumps and screened ignition but excluding airscrew hub, bearer feet and exhaust stubs 354 lb. (160.5 kg.) + $2\frac{1}{2}\%$.

PERFORMANCE.—
Take-off 180 h.p. at 2,600 r.p.m. at sea level.
Max. continuous power rating 158 h.p. at 2,300 r.p.m. at 1,250 ft. (380 m.).
Max. weak mixture power 140 h.p. at 2,200 r.p.m. at 3,250 ft. (990 m.).

FUEL CONSUMPTIONS.—
Max. take-off (upper limit) 13.75 Imp. gallons (62.42 litres) per hour.
Max. continuous (upper limit) 10.75 Imp. gallons (48.80 litres) per hour.
Max. weak mixture 9.25 Imp. gallons (42.00 litres) per hour.

OIL CONSUMPTION.—
At max. continuous rating 1.0 to 3.5 pints (0.57 to 1.98 litres) per hour.



The 100 h.p. Cirrus Minor Series II air-cooled engine.

THE CIRRUS MINOR SERIES II.

TYPE.—Four-cylinder in-line inverted air-cooled.

CYLINDERS.— Bore 3.9 in. (100 mm.). Stroke 5 in. (127 mm.). Capacity 243.5 cub. in. (3.99 litres). Compression ratio 6.25 : 1. Carbon steel cylinders with machined fins. Pent-roof type Y-alloy detachable head attached to cylinder by eight studs and nuts. A gas-tight joint is secured by a spigot on the cylinder and a copper washer. Cylinders attached to crankcase by short anchoring studs.

PISTONS.—Slipper type of Y-alloy. Fully-floating gudgeon-pins. One scraper and two compression rings.

VALVE GEAR.—One inlet and one exhaust valve per cylinder, operated from camshaft through cup-ended tappets, rocker arms and ball-ended push-rods. Clearance adjusted by screwed cup in one end of rocker. Valves stellited. Camshaft in crankcase has a phosphor bronze thrust-bearing at the front end from which end the camshaft

is driven through spur gears. Timing gears at front of engine.

CONNECTING RODS.—Hiduminium forgings with steel-backed white metal bearings.

CRANKSHAFT.—Steel forging carried in five plain white-metal bearings. Ball thrust bearing at the front end and gear wheel at rear end for driving the two vertical magneto drive-shafts, which also operate the fuel pumps.

CRANKCASE.—Electron casting with all oil-ways internal. Electron top-cover carries a one-piece cast breather at the rear, and lifting eyes fore and aft.

IGNITION.—Two B.T.H. SG4-2 magnetos (one with impulse starter) driven from crank-shaft through spiral gears. Integrally screened sparking-plugs. Plessey-Breeze screening harness optional.

CARBURATION.—Zenith downdraught carburettor with independent mixture control, also hot and cold air intake, on one-piece cast induction-manifold. Warm air from the cowling is admitted through the flame-trap up to approximately 90% of the throttle opening, after which a direct cold air intake comes into operation. Provision for fire-fighting attachments on induction manifold. Dual fuel-pumps operated by cams on magneto driving shaft.

FUEL.—73 Octane minimum. Fuels containing tetra-ethyl-lead can be used.

LUBRICATION.—Gear-type oil-pump, incorporating Auto-clean filter. Pressure-feed system to main and big-end bearings. Gravity drain system. An extension of the oil-pump spindle provides a power take-off point.

ACCESSORIES.—Amal petrol pump ; B.T.H. or Hymatic compressor ; B.T.H. or Rotax starter ; Rotax generator ; vacuum pump.

AIRSCREW DRIVE.—Direct left-hand tractor.

DIMENSIONS.—
Overall length less spinner less starter 37.6 in. (955 mm.).
Height 26.02 in. (661 mm.).
Width 15.2 in. (386 mm.).

WEIGHT.—
Including airscrew hub but excluding fuel pumps, bearer feet and exhaust stubs 240 lb. (108.9 kg.).

PERFORMANCE.—
Take-off output 92 h.p. at 2,300 r.p.m. at sea level.
Max. cruising 82 h.p. at 2,300 r.p.m. at 3,000 ft. (915 m.).
Max. weak mixture 78 h.p. at 2,200 r.p.m. at 3,000 ft. (915 m.).
Max. output 100 h.p. at 2,600 r.p.m.

FUEL CONSUMPTIONS.—
Max. cruising 6.0 Imp. gallons (27.27 litres) per hour.
Max. weak mixture 5.5 Imp. gallons (25 litres) per hour.

OIL CONSUMPTION.—
1 to 2 pints (0.57 to 1.13 litres) per hour.

THE CIRRUS MAJOR SERIES III.

TYPE.—Four-cylinder in-line air-cooled inverted.

CYLINDERS.—Bore 4.724 in. (120 mm.). Stroke 5.512 in. (140 mm.). Capacity 386.4 cub. in. (6.3 litres). Compression ratio 6.5 : 1. Barrels are machined from high-grade steel ingots and are located in crank case by large spigot and four short studs securing cylinder base flange. Cylinder-heads are of aluminium-alloy with one inlet and one exhaust valve. Heads attached to barrels by twelve securing studs.

VALVE GEAR.—Operation, etc., as in Minor Series II.

PISTONS.—Slipper type of Y-alloy, with two tapered compression and one scraper rings.

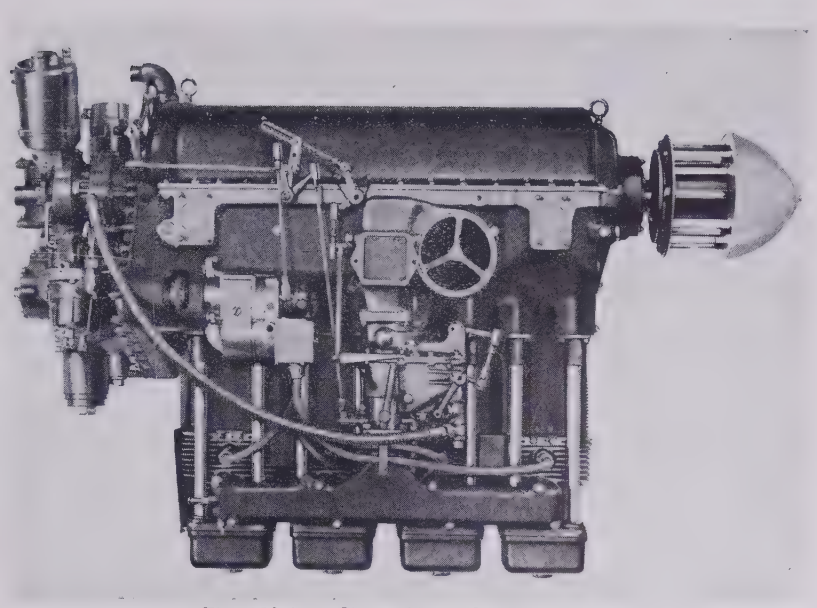
CONNECTING RODS.—Hiduminium forgings fitted with steel-backed white-metal bearings.

CRANKSHAFT.—Steel forging, machined all over carried in five plain bearings. Ball thrust-bearing at front end.

CRANKCASE.—Aluminium-alloy casting with Electron tip-cover. The timing-gear cover at rear carries the auxiliaries and does not disturb any gears when removed as they are housed in the crankcase.

CARBURATION.—One Claudel-Hobson downdraught carburretor, with flame-trap and direct cold air intake, and having an independent mixture control, on one-piece cast induction manifold. The cold air intake operates automatically at approximately 90% to full-throttle opening. Provision for fire-fighting attachments on induction manifold.

FUEL.—80 Octane minimum. Fuels containing tetra-ethyl-lead can be used.



The 158 h.p. Cirrus Major Series III engine.

IGNITION.—Two B.T.H. magnetos, one with impulse starter. Lodge or K.L.G. sparking plugs of approved types. Plessey screened harness if desired.

LUBRICATION.—Pressure feed system with scavenge pump. All oilways internal in crankcase casting. Pressure and scavenge filters embodied in the oil-pump.

AIRSCREW DRIVE.—Direct, left-hand tractor.

ACCESSORIES.—Rotax (electric) or Coffman (cartridge) starter, Rotax or Pesco vacuum-pump, Rotax generator, B.T.H. or Hymatic Compressor.

DIMENSIONS.—
Overall length less spinner 40.7 in. (1,034 mm.).
Overall height 30.8 in. (782.5 mm.).
Overall width 15.2 in. (386 mm.).

WEIGHT.—
Including airscrew hub but excluding fuel pumps, bearer feet and exhaust stubs 345 lb. (156.6 kg.) + 2½%.

PERFORMANCE.—
Take-off output 146 h.p. at 2,200 r.p.m. at sea level.
Max. cruising output 138 h.p. at 2,200 r.p.m. at 1,500 ft. (460 m.).
Max. output 158 h.p. at 2,450 r.p.m. at sea level.

FUEL CONSUMPTIONS.—
Take-off 11 gallons (50 litres) per hour.
Max. cruise 10 gallons (45.4 litres) per hour.

OIL CONSUMPTION.—
Max. cruise 0.75 to 2.0 pints (0.43 to 1.13 litres) per hour.

DE HAVILLAND

THE DE HAVILLAND ENGINE CO., LTD.

HEAD OFFICE : STONEGROVE, EDGWARE, MIDDLESEX.

Directors : Major F. B. Halford, C.B.E., F.R.Ae.S., M.S.Ae. (Chairman), F. T. Hearle, C.B.E., M.I.P.E., F.R.Ae.S., Sir Geoffrey de Havilland, C.B.E., A.F.C., F.R.Ae.S., R.D.I., W. E. Nixon, F.C.I.S., F. E. N. St. Barbe, J. L. P. Brodie, M.I.A.E., M.I.Mech.E., H. Buckingham, and A. F. Burke, O.B.E., M.Inst.T., F.R.S.A. (Managing).

The de Havilland Engine Co. Ltd. was formed in February, 1944, from the Engine Division of the de Havilland Aircraft Co., Ltd. The Chairman and Technical Director is Major Frank B. Halford, C.B.E., F.R.Ae.S., M.S.Ae., who with a team of designers and engineers which has remained largely unchanged for 20 years, has designed all de Havilland aero-engines since the Gipsy I, four-cylinder light engine was first produced in 1927.

The current range of Gipsy engines includes the 250 h.p. direct-drive normally-aspirated Gipsy Queen Series 30 and the 340 h.p. and 380 h.p. (Mk. 2) geared and supercharged Gipsy Queen Series 70, both six-cylinder engines ; and the 145 h.p. Gipsy Major 10 four-cylinder engine.

The Gipsy Queen Series 70 is the power unit of the D.H. Dove twin-engined light transport and is also fitted to the Short Sealand amphibian and the Handley Page Marathon. The Gipsy Queen 30 Mark 2 is the power-plant of the de Havilland Heron four-engined feeder liner.

The Gipsy Major 10 is an improved and refined post-war version of the Gipsy Major I. It can be fitted with an electric starter, generator and vacuum pump if required and is adaptable for either a fixed-pitch or, in the case of the Mk. 2 engine, the D.H. manually-operated controllable-pitch propeller. The current forms of this engine are the Series 10 Mark 2 and the Series 8.

Details of de Havilland gas-turbine engines will be found in Part I of this Section.

THE D.H. GIPSY QUEEN SERIES.

TYPE.—Six-cylinder in-line inverted air-cooled direct-drive (Series 30) or geared and supercharged (Series 70).

CYLINDERS.—Bore 4.725 in. (120 mm.). Stroke 5.905 in. (150 mm.). Swept volume 622 cub. in. (10.178 litres). Compression ratio 6.5 : 1. Barrels machined all over from carbon steel forgings. Working portion of bore hard-chromed. Barrel spigots into crankcase and aluminium-alloy head clamped to barrel and crankcase by four long steel studs. Moulded Dermatine or Neoprene ring between cylinder and crankcase and plain copper washer between barrel and head.

PISTONS.—Fully-skirted, machined from light alloy forgings with two compression and one scraper rings. Fully floating gudgeon-pin located by external circlips and washers.

CONNECTING RODS (Series 30).—I-section aluminium-alloy forgings. Split big-ends have thin-wall linings. Small-end bearings unbushed and drilled for lubrication.

CONNECTING RODS (Series 70).—I-section nickel-chrome steel forgings. Split big-ends with thin-wall linings. Small-ends have phosphor-bronze bushes.

CRANKSHAFT.—Six-throw shaft is a nickel-chrome forging machined all over and statically and dynamically balanced. Shaft runs on eight plain main bearings in case of Queen 30 and seven in case of Queen 70. Bearings of normal split type lined with thin-wall shells which consist of a steel strip backing lined with lead-bronze on which thin skin of lead is deposited. A fine wall of indium is infused into bearing surface. In case of Series 70 an epicyclic reduction gear is driven off crankshaft through non-lined spring coupling. Gear ratio 0.711 : 1. Propeller shaft is supported at the rear by two plain white-metalled bearings and at the front by single-row ball-bearing transmitting thrust in either direction through reduction-gear casing.

CRANKCASE (Series 70).—Aluminium-alloy main case stiffened by cross webs which carry the main and camshaft bearings, and additionally strengthened by two cross bolts, passing through the upper part of web and bearing cap of Nos. 1 and 4 main bearings. Rear wall extends below level of cylinder mounting face to form sump. Top cover is magnesium-alloy casting and carries magnetos, distributors, vacuum pump, air compressor (hydraulic pump alternative) and their drives.

CRANKCASE (Series 30).—Basically similar to that of Queen 70, main differences being that it is in magnesium-alloy, that a cross shaft bolt is only fitted at No. 4 main bearing and that rear of crankcase is closed by rear cover.

VALVE GEAR.—Fully enclosed, one inlet and one exhaust valve to each cylinder. Operation by steel rockers, tubular aluminium-alloy push-rods and steel tappets of hollow steel camshaft running in plain bearings in port side of crankcase. Camshaft driven by spur gears from front end of crankshaft. Both inlet and exhaust valve stems tipped with Stellite and head of exhaust valve and that portion of stem exposed to exhaust gases surfaces with Brightray. Solium-cooled exhaust valves.

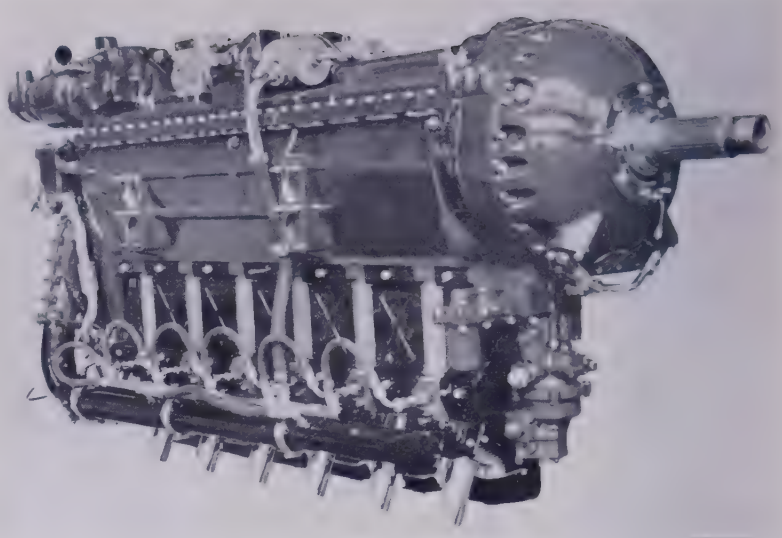
INDUCTION (Series 30).—Pair of single-choke Hobson type A.I.55E/1 downdraught carburettors, each feeding three cylinders through separate three-branch manifolds. Air intake incorporates hot and cold air intake shutter and flame-trap.

INDUCTION (Series 70).—Hobson type DHG/1 fuel-injection unit metering fuel through injection nozzle into eye of supercharger impeller.

SUPERCHARGER (Series 70). Centrifugal type driven through two gear trains and a spring quillshaft which is co-axial with end passes through hollow camshaft. Gear Ratio 11.22 : 1.

IGNITION.—Two screened B.T.H. type CGD magnetos and B.T.H. distributors mounted on crankcase top cover and gear-driven from an auxiliary drive shaft at 1½ and ½ times engine speed respectively. Two sparking plugs per cylinder. Fixed ignition.

LUBRICATION.—Dry sump system, one pressure and two scavenge pumps with fabric-type pressure filter. Gauze filters on suction side for all three pumps. Main bearings, big end and most bearings fed with oil under pressure. Pistons and cylinder walls sprayed with oil by jets from big ends supplemented by oil mist; other moving parts by oil mist or splash. Valves and rocker gear operate in oil baths. Provision for Worth oil dilution system.



The 380 h.p. de Havilland Gipsy Queen Series 70 Mk. 2 engine.

ACCESSORIES.—All accessories driven off rear of auxiliary drive shaft, each accessory coupled to its driving gear by splined coupling sleeve. Electric starter complete with hand turning gear or feathering pump is provided. Accessories include vacuum pump, generator up to 1,500 watts and provision can be made for compressor or hydraulic pump.

COOLING.—Scoops are fitted to the port side of the engine. Air collected by these scoops is passed between the cylinders and heads and suitably deflected by special baffles on starboard side of engine.

AIRSCREW (Queen 70).—Either (*a*) de Havilland bracket constant-speed type airscrew, or (*b*) de Havilland hydromatic constant-speed feathering and braking airscrew, or other approved constant-speed airscrew.

AIRSCREW (Queen 30).—(*a*) or (*b*) as above. In addition (*c*) any approved type of fixed-pitch airscrew, either metal or wood.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE DE HAVILLAND GIPSY MAJOR 10.

TYPE.—Four-cylinder in-line inverted air-cooled, direct-drive.

CYLINDERS.—Bore 4.646 in. (118 mm.). Stroke 5.512 in. (140 mm.). Capacity 373.6 cub. in. (6.124 litres). Compression ratio 6 : 1. Barrels machined all over

THE DE HAVILLAND GIPSY QUEEN AND GIPSY MAJOR ENGINES.

Engine Type	Gipsy Queen 30 Mk. 2	Gipsy Queen 70-4	Gipsy Queen 70 Mk. 2	Gipsy Major 10 Mk. 2
Take-off Power	240-250 h.p. at 2,500 r.p.m. at sea level Fuel consumption 18.75-19.5 gals. (85.1-88.5 litres) per hr.	325-340 h.p. at 2,800 r.p.m. at sea level Fuel consumption 32.75 gals. (147.3 litres) per hr.	365-380 h.p. at 3,000 r.p.m. at sea level Fuel consumption 36.5-38 gals. (161.3-168 litres) per hr.	139-145 h.p. at 2,550 r.p.m. at sea level Fuel consumption 11.0-11.5 gals. (50-52.2 litres) per hr.
Maximum Continuous Power	240-250 h.p. at 2,500 r.p.m. at sea level Fuel consumption 18.75-19.5 gals. (84.3-87.7 litres) per hr.	316-330 h.p. at 2,600 r.p.m. at 5,000 ft. (1,525 m.) Fuel consumption 23.5-24.5 gals. (106.7-111.2 litres) per hr.	341-355 h.p. at 2,700 r.p.m. at 4,250 ft. (1,296 m.) Fuel consumption 31.6-32.9 gals. (142.2-148 litres) per hr.	136-142 h.p. at 2,400 r.p.m. at sea level Fuel consumption 10.75-11.25 gals. (48.3-50.6 litres) per hr.
Maximum Weak Mixture Power	206 h.p. at 2,500 r.p.m. at 2,900 ft. (884 m.) Fuel consumption 12.3-12.9 gals. (55.9-58.5 litres) per hr.	265 h.p. at 2,400 r.p.m. at 8,000 ft. (2,440 m.) Fuel consumption 17.5 gals. (79.5 litres) per hr.	265 h.p. at 2,400 r.p.m. at 8,000 ft. (2,440 m.) Fuel consumption 16.8-17.5 gals. (75.6-78.7 litres) per hr.	125 h.p. at 2,300 r.p.m. at 3,000 ft. (915 m.) Fuel consumption 8.85-9.0 gals. (39.8-40.5 litres) per hr.
Weight dry (including cooling scoops, baffles and fuel-pump unit)	525 lb. (238.3 kg.) + 2½%	685 lb. (311 kg.) + 2½%	690 lb. (313 kg.) + 2½%	325 lb. (147.5 kg.) + 2½%
Supercharger gear ratio	—	11.22 : 1	11.22 : 1	—
Airscrew gear ratio	—	0.711 : 1	0.711 : 1	—
Overall length (from centre-line of airscrew)	61.5 in. (1,562 mm.)	71.75 in. (1,822 mm.)	71.75 in. (1,822 mm.)	42.1 in. (1,070 mm.)
Overall width	19.59 in. (497.5 mm.)	19.56 in. (497 mm.)	19.56 in. (497 mm.)	20.1 in. (510 mm.)
Overall height	32.99 in. (838 mm.)	33.23 in. (844 mm.)	33.23 in. (844 mm.)	30.6 in. (777 mm.)
Fuel Grade	Min. Octane 91/96 Max. lead content 5.5 cc. TEL/gal.	Min. Octane 100-130 Max. lead content 5.5 cc. TEL/gal.	Min. Octane 100-130 Max. lead content 5.5 cc. TEL/gal.	Min. Octane 80 Max. lead content 5.5 cc. TEL/gal.

from forgings of carbon steel. Detachable heads of aluminium-alloy held by long H.T. steel studs to crankcase. Copper-asbestos gasket between cylinder barrel and head to ensure gastight joint.

Pistons.—Slipper type machined from aluminium-alloy forgings. Fully-floating gudgeon-pin located by external circlips and washers. One scraper and two compression rings below gudgeon pin.

Connecting Rods.—Machined all over from light-alloy stampings with split big-ends clamped together by four bolts and nuts. Big-end bearing of steel-backed white metal-lined type. Small end bearings unbushed.

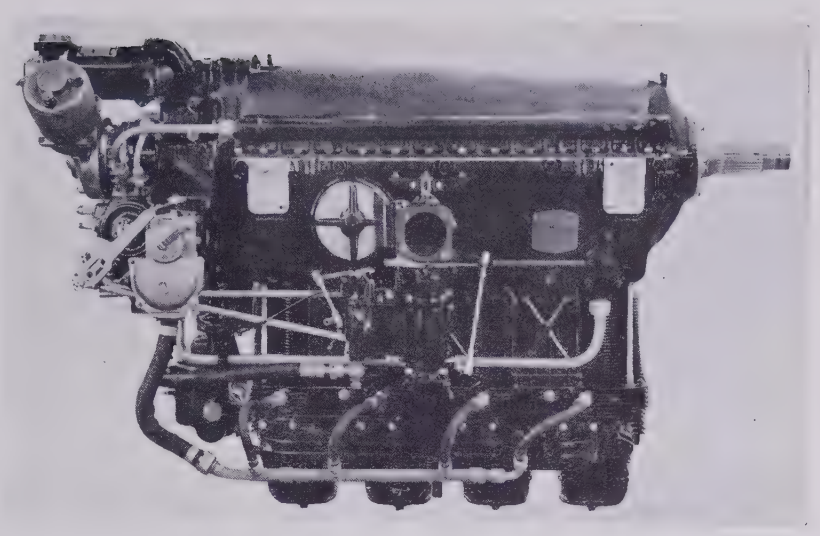
Crankshaft.—Machined all over from nickel-chromium-alloy steel forgings. Statically and dynamically balanced. Five steel-backed thin-wall Vandervell type main bearings. Ball-bearing to take thrust at front end. Journals and pins bored for lightness and lubrication.

Crankcase.—Aluminium-alloy casting. Lower half carries the five main crankshaft bearings, which are held in position by separate caps. Top cover is of magnesium-alloy stoutly ribbed to resist deflection.

Valve Gear.—Fully enclosed. One inlet and one exhaust valve to each cylinder. Sodium-cooled exhaust valves are used in the Series 10 Mk. 2 and Series 8. Operation by steel rockers, tubular steel push-rods, and steel tappets off camshaft running in five bearings on port side of engine. The camshaft is driven by spur-gears from rear end of crankshaft.

Induction.—Claudel-Hobson AI.48 down-draught carburettor. Two position independent control change-over flap enables warm air to be selected by pilot under icing conditions. Altitude control is provided by an air valve in carburettor, operated from cockpit Twin D.H. A.C. fuel pumps complete with hand-priming levers and remote controls for carburettor flooder fitted to port side of the crankcase and driven by cams from camshaft.

Ignition.—Two B.T.H. magnetos mounted in inverted position on either side of rear cover. Impulse starter coupling on starboard magneto. Igniton equipment can be supplied screened or unscreened as required.



The 145 h.p. de Havilland Gipsy Major 10 Mk. 2 engine.

Lubrication.—Dry sump system. Engine-driven gear-type pump delivers at a pressure of 40 to 45 lb. per sq. in. (2.81 to 3.16 kg . cm.^{2}) to an Auto Klean-filter. Crankshaft, connecting-rods, camshaft and timing gear are pressure-fed from the main oilway. Cylinders lubricated by splash from connecting rod big-ends. Secondary external oil pipe lubricates all accessory drives and bearings on rear cover above crank-shaft gear. Remaining gears and bearings in lower part of cover lubricated by splash oil from magneto gears and leakage past idler gear bushes which receive pressure oil from rear main bearings. Valve rocker gear lubricated separately by splash from rocker covers which are filled with oil to prescribed level.

Accessories.—The following accessories are driven from rear of crankshaft:—Vacuum pump, generator up to 500 watts, and there is provision for an electric or cartridge starter driving through a 12-jaw dog.

Cooling.—Same as for Gipsy Queen.

Airscrew Drive.—Direct. Left-hand tractor. Provision for fixed-pitch wood or metal airscrew of approved design or D.H. manually-operated variable-pitch airscrew, (15° pitch range), on No. 1 SBAC parallel-splined shaft.

Dimensions, Weights and Performance.—See Table.

ROLLS-ROYCE

ROLLS-ROYCE, LTD.

Head Office: Derby.

Works: Derby, Crewe and Glasgow.

London Office: 14-15, Conduit Street, W.1.

Established: March 15, 1906.

Directors: The Rt. Hon. Lord Hives, C.H., M.B.E. (Chairman and Joint Managing Director), A. G. Elliott, C.B.E. (Joint Managing Director and Chief Engineer), Brigadier H. K. M. Kindersley (Deputy Chairman), Harold Peake, M.A., W. T. Gill, The Hon. M. F. P. Lubbock, Dr. F. Llewellyn Smith, M.Sc., W. A. Robotham, M.I.Mech.E. and J. D. Pearson, Wh.Sch., B.Sc., M.I.Mech.E., A.F.R.Ae.S., M.I.P.E. (Chief Executive, Aero-engine Division).

Although the productive capacity of Rolls-Royce is now almost entirely devoted to gas-turbine engines of both the turbojet and turboprop types, Rolls-Royce liquid-cooled piston engines of the Merlin and Griffon types are still in widespread use. The latest type of these two engines are described below.

Details of Rolls-Royce gas-turbine engines will be found in Part I of this section.

THE ROLLS-ROYCE GRIFFON.

The Griffon 57 powers the Avro Shackleton, a four-engined long-range reconnaissance aircraft which is in production for the R.A.F.

The Griffon 74 which powers the Fairey Firefly was designed to meet the requirements of the Royal Navy, the Royal Australian Navy and the Royal Netherlands Navy. It is fitted with a Rolls-Royce injection pump by means of which fuel is discharged into the eye of the supercharger.

The specification that follows is generally applicable to all Griffon engines, but it should be noted that all marks of Griffon below the Mark 60 Series have two-speed single-stage superchargers and those above this mark number two-speed two-stage superchargers.

Type.—Twelve-cylinder 60° Vee liquid-cooled.

Cylinders.—Bore 6.0 in. (152.4 mm.). Stroke 6.6 in. (167.64 mm.). Swept volume 2,240 cub. in. (36.7 litres). Two blocks of six cylinders, with separate light alloy cylinder-head. Separate high carbon steel liners. Heads carry renewable stellited valve seatings. Inlet and exhaust valve guides of cast iron and lead-bronze respectively.

Pistons.—R.R.59 alloy. Two compression rings and two drilled and grooved scraper rings, one above and one below gudgeon-pin. Fully-floating gudgeon-pin located by spring wire circlips.

Connecting Rods.—Nickel steel forgings machined all over. Each assembly consists of plain rod and forked rod, the latter carrying a nickel steel bearing block which retains a split flanged thin steel shell lined with lead-bronze which runs directly on crankpin. Similar split bearing shells on the plain rod work on outer surface of the forked rod block. Small end of each connecting-rod houses a fully-floating bronze bush.

Crankshaft.—One-piece six-throw machined forging of nitrogen-hardened chrome-molybdenum steel. Drive to reduction gear pinion by serrated flange bolted to front end of shaft. Rear end of shaft is connected by flexible torsion shaft to supercharger driving gear and also provides drives to auxiliary gearbox, oil pumps, coolant pumps, fuel pump, tachometer and constant-speed unit.

Crankcase.—In two halves. Both castings of aluminium-alloy. Upper portion carries cylinders and crankshaft main bearings. Front of crankcase forms integrally the rear housing of the airscrew reduction gear and also contains camshaft and starter motor drives. Lower portion forms engine sump and contains oil pump assembly.

Valve Gear.—Two inlet and two exhaust valves per cylinder. Inlet and exhaust valves are of K.E.965 steel, a protective layer of Brightray covering whole of combustion face and seat of the exhaust valve and seat only of the inlet valve. Sodium-cooled exhaust valves. Single central camshaft to each cylinder block operates both inlet and exhaust valves.

Induction.—On later marks of Griffon R.R. injection-pump and combined feed-pump and metering device in one unit. Metering is effected by two jets in parallel, whose free areas are controlled by taper needles, one needle being operated by a capsule subject to boost-pressure and atmospheric pressure (exhaust back-pressure) and the other by a temperature sensitive device in induction pipe. Pressure difference across the jets is controlled by engine speed by means of a flexible diaphragm connected to a needle valve and loaded by a centrifugal governor driven by the engine on same shaft as feed-pump.

Supercharger.—Both single and two-speed two-stage superchargers are of the two-speed centrifugal type, the change-speed mechanism of which is operated by an automatic change-over mechanism incorporating an electric-hydraulic system operated by an atmospherically-controlled aneroid. Delivery pressure of the supercharger is controlled by an automatic servo mechanism coupled through a differential linkage to the throttle so that a constant-boost-pressure is maintained at altitude up to full throttle conditions for a fixed position of the pilot's lever.

Ignition.—Two twelve-cylinder magnetos in one unit and mounted in the Vee directly behind the reduction-gear housing. Driven by bevel gears and an inclined shaft from the port camshaft drive.

Lubrication.—Dry-sump system. One pressure and two scavenge gear type pumps. Pressure pump delivers oil to two relief valves in one unit which controls oil pressure to a high and low pressure system. Any excess oil is spilled back directly into crankcase. High pressure system feeds the crankshaft journal bearings, connecting-rod bearings and constant-speed unit. High pressure oil is also taken from delivery side of main pressure pump for operating change-speed mechanism for two-speed supercharger drive. Low pressure system is used for feeding oil to camshaft and rocker mechanism oil jets feeding airscrew reduction gears, supercharger drive gears, and various other bearings throughout engine.

Coolant System.—Coolant employed is mixture of 70% water and 30% ethylene glycol. Coolant is circulated by centrifugal-type pump to cylinder blocks and from cylinder blocks to small-capacity header-tank and from header tank via a radiator to coolant-pump inlet. Loaded relief valve in header tank seals whole coolant

ROLLS-ROYCE GRIFFON ENGINES.

Bore × Stroke: 6 in. × 6.6 in. (152.5 mm. × 167.6 mm.). Capacity: 2,240 cu. in. (36.7 litres).

Engine	Take-off Power	International Rating	Maximum Power	Dry Weight (plus 2½% tolerance)	Airscrew Gear Ratio	Compression Ratio	Remarks
Griffon 57	2,500 h.p. at 2,750 r.p.m.	1,660 h.p. at 2,600 r.p.m. at 5,500 ft. (1,680 m.) and 1,540 h.p. at 2,600 r.p.m. at 12,550 ft. (3,830 m.)	2,030 h.p. at 2,750 r.p.m. at 1,760 ft. (540 m.) and 1,850 h.p. at 2,750 r.p.m. at 9,750 ft. (2,970 m.)	2,100 lbs. (953 kg.)	.4423 : 1 Contra-rotating	6.00 : 1	Contra-rotating airscrews. Installed in Avro Shackleton.
Griffon 74	2,004 h.p. at 2,750 r.p.m.	1,510 h.p. at 2,600 r.p.m. at 7,500 ft. (2,280 m.) and 1,405 h.p. at 2,600 r.p.m. at 20,500 ft. (6,250 m.)	2,045 h.p. at 2,750 r.p.m. at sea level and 2,245 h.p. at 2,750 r.p.m. at 9,250 ft. (2,820 m.)	2,100 lbs. (953 kg.)	.510 : 1	6.00 : 1	Installed in Firefly 5 and 6.

system up to a predetermined pressure. This raises boiling point of coolant, and permits use of smaller radiators. Header tank relief valve also incorporates suction-operated valve which admits air, if for any reason pressure falls below atmospheric.

Coolant System (Griffon 57).—Closed circuit shunt system. With this system pressure loss on inlet side of coolant pump which would upset mass circulation is eliminated. Coolant flows from pump through cylinder blocks to swirl-type outlets at top of blocks, then to radiator and back to pump. Swirl outlets separate vapour from coolant and pass it to header tank, which acts as reservoir for coolant and is connected to venturi at pump inlets. Should any decrease in pressure occur at pump due to cavitation it is immediately restored by flow of coolant from header tank to venturi.

Intercooler System (Griffon 74).—Coolant employed is mixture of 70% water and 30% ethylene glycol which is circulated by means of centrifugal pump from header tank through a radiator in jacket situated between two stages of the supercharger and to the intercooler matrix, placed between supercharger and induction pipe, and thence back to header tank. This system which is entirely independent of main engine system is pressurised and incorporates similar design of header tank, relief valve and radiator-cooling air control as on main system, but no thermostat. Heat exchange from coolant is carried out by an independent radiator in aircraft system in normal manner.

Starting.—The starting system on all Griffons except Mk. 57 is of Coffman combustion type. On Griffon 57 Rotax direct-turning 24-volt type C.3304 starter, complete with Bendix engaging clutch and gears mounted in same position as combustion starter.

Auxiliaries.—All the aircraft service accessories are mounted on separate gearbox on bulkhead and driven by shaft through universal joints from top of wheelcase. This gearbox has its own independent lubrication system and supply.

Airscrew Drive (All except Mk. 57).—Left-hand tractor. Single spur reduction gear. Hollow driving pinion mounted in two roller bearings is concentric with, and is driven by, hollow coupling shaft serrated at both ends. One end engages with a serrated driving ring on crankshaft and forward end with internal serrations on driving pinion. This coupling shaft insulates reduction gear unit from crankshaft loadings and torsional vibrations. Hollow airscrew shaft has an integral flange which is bolted to ring gear driven by pinion, and is mounted in roller-bearings, axial thrust being taken in either direction by ball thrust-bearing.

Airscrew Drive (Griffon 57).—Contra rotating. Drive from crankshaft is through coupling shaft to double pinion. Rear pinion drives gear wheel bolted to inner airscrew shaft which is thus driven in opposite direction to that of crankshaft. Front pinion drives an idler wheel which in turn drives a gear wheel bolted to outer airscrew shaft. Two shafts are connected co-axially and reversing thrust loads are taken by thrust bearing mounted between two shafts. Primary thrust taken by second bearing located on outer shaft and housed in reduction gear casing. Shafts are S.B.A.C. size 4 and 6 and, in addition, inner shaft is increased in length for use of feathering airscrews for multi-engined aircraft.

Weights and Performance.—See Table.

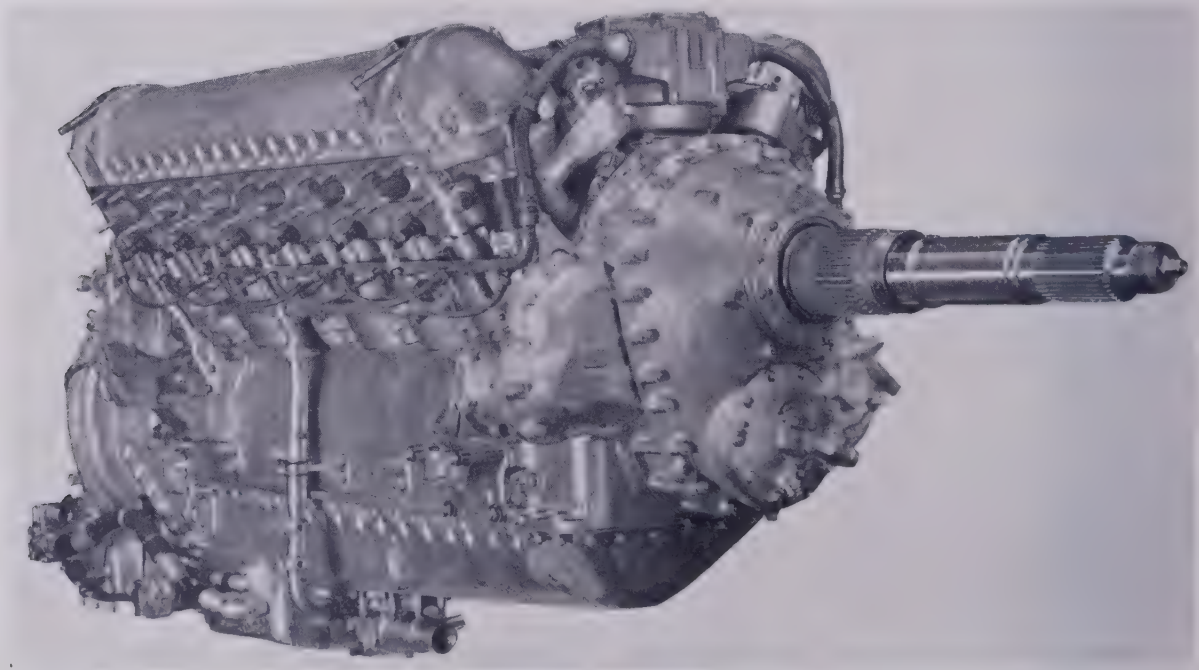
THE ROLLS-ROYCE MERLIN.

To provide a clear distinction between military Merlin engines and civil types, the mark numbers for the civil engines begin at 500 and 600. The 500 series covers the two-speed single-stage supercharged civil Merlin engines, and the 600 Series cover civil engines equipped with two-speed two-stage superchargers as, for example, the Merlin 620 engine.

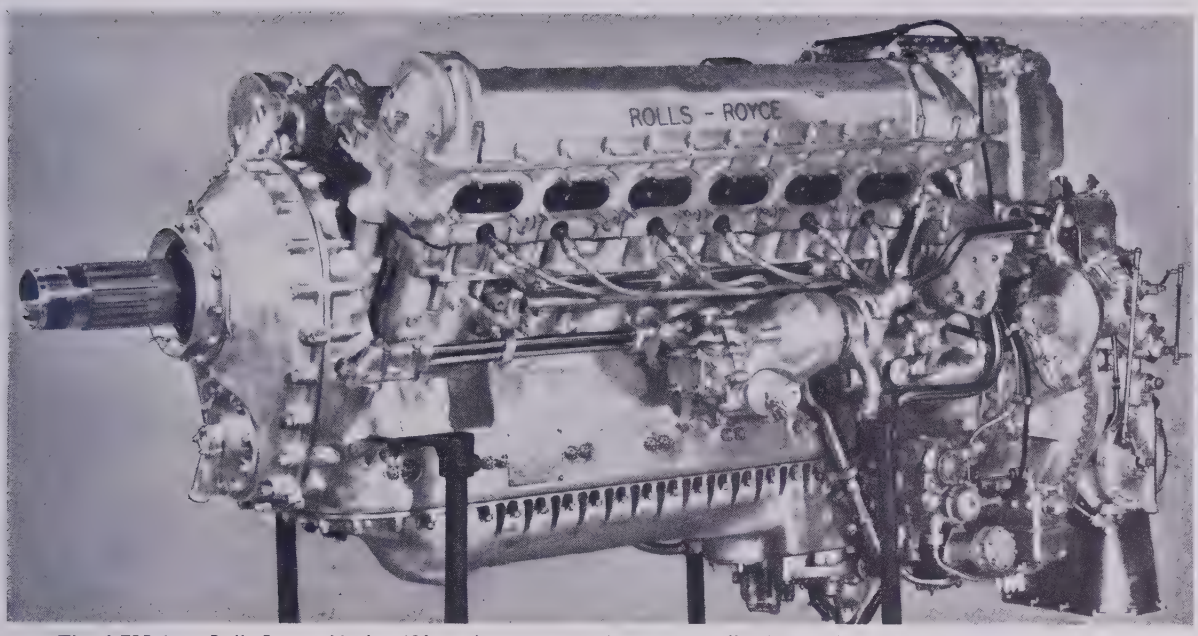
Merlin 620 Series engines power the Trans-Canada Air Lines' fleet of "North Star" airliners and the fleet of Canadair Four airliners in service with the British Overseas Airways Corporation.

The Merlin 140 powers the Short Sturgeon and is equipped to drive contra-rotating airscrews. It has fuel-injection and an updraught air intake.

Type.—Twelve-cylinder 60° Vee liquid-cooled.



The 2,500 h.p. Rolls-Royce Griffon 57 engine with two-speed single-stage supercharger and gearing for contra-rotating airscrews, four of which power the Avro Shackleton.



The 1,725 h.p. Rolls-Royce Merlin 620 civil engine which was specially designed to power the Canadair Four.

CYLINDERS.—Bore 5.4 in. (137.16 mm.). Stroke 6 in. (152.4 mm.). Swept volume 1,647 cub. in. (27 litres). Two two-piece cylinder blocks of cast R.R.50 aluminium-alloy have separate heads and skirts. Six cylinder liners of high carbon steel in each block. Renewable Silchrome valve seatings screwed into cylinder heads. Valve guides of cast-iron for inlets and phosphor bronze for exhausts.

PISTONS.—Machined from forgings of R.R.59 alloy. Three compression and one scraper ring. Lower gas ring has groove to enable it to act as scraper ring. Fully-floating hollow gudgeon pins of hardened nickel-chrome steel retained in position by spring circlips.

CONNECTING RODS.—Nickel steel forgings machined to H-section all over. Each pair consists of plain rod and forked rod, latter carries nickel-steel bearing block which accommodates the steel backed lead bronze alloy bearings. Small-end of each connecting rod houses floating lead-bronze bush.

CRANKSHAFT.—One-piece six-throw. Machined forging of chrome-molybdenum steel. Integral balance-weights. Nitrogen-hardened. Drive to reduction-gear pinion is through a splined coupling shaft which fits into a splined flange bolted to front end of crankshaft. Drive from crankshaft to supercharger and timing gears and auxiliary components is through torsionally flexible shaft which provides spring drive. Twisting of this shaft is limited by hollow sleeve, having stops to restrict angular movement and also to form a solid drive.

CRANKCASE.—In halves. Both castings of aluminium-alloy. Upper portion carries cylinders, bearings of crankshaft and part of housing for airscrew reduction gear. Lower portion is sump case and carries the oil pumps and filters. Main bearings, split mild-steel shells lined with lead-bronze alloy, fit into recesses machined in the crankcase.

WHEELCASE.—Aluminium casting secured by studs at rear end of crankcase. Supercharger unit goes on to back of wheelcase. Latter houses drives to the camshafts, magnetos, coolant and oil pumps, supercharger, fuel-metering pump, constant-speed unit, intercooler pump, electric starter and the drive to the auxiliary gear-box.

VALVE GEAR.—Two inlet and two exhaust valves of K.E. 965 steel. Inlet and exhaust valves are Brightray-treated over crown and seating surfaces and have Stellited ends. Exhaust valves are also sodium-cooled. Helices of exhaust valve springs are same to promote rotation and prevent continued seating in one position. Camshaft, along

ROLLS-ROYCE MERLIN ENGINES.

Bore × Stroke: 5.4 in. × 6 in. (137.3 mm. × 152.5 mm.). Capacity: 1,649 cu. in. (27 litres).

Engine	Take-off Power	Emergency Maximum Power	Maximum Climbing Power	Continuous Cruising Power	Dry Weight	Airscrew Gear Ratio	Remarks
Merlin 140	1,725 h.p. at 3,000 r.p.m.	1,780 h.p. at 3,000 r.p.m. at 4,500 ft. (1,370 m.) and 1,650 h.p. at 3,000 r.p.m. at 16,750 ft. (5,110 m.)	1,410 h.p. at 2,850 r.p.m. at 10,000 ft. (3,050 m.) and 1,315 h.p. at 2,850 r.p.m. at 20,500 ft. (6,250 m.)	1,200 h.p. at 2,650 r.p.m. at 10,250 ft. (3,130 m.) and 1,185 h.p. at 2,850 r.p.m. at 23,750 ft. (7,245 m.)	1,780 lbs. (808 kg.)	.512 : 1 (Contra-rotating)	Two-speed two-stage supercharger. Intercooled. R.R.-S.U. fuel injection pump. R.R. accessory gear-box.
Merlin 500	1,610 h.p. at 3,000 r.p.m.	1,635 h.p. at 3,000 r.p.m. at 2,250 ft. (690 m.) and 1,510 h.p. at 3,000 r.p.m. at 9,250 ft. (2,820 m.)	—	1,080 h.p. at 2,650 r.p.m. at 8,750 ft. (2,670 m.) and 1,015 h.p. at 2,650 r.p.m. at 15,500 ft. (4,730 m.)	1,525 lbs. (692 kg.)	.420 : 1 (R.H. tractor)	Two-speed single-stage supercharger. S.U. anti-"G" float type carburetter.
Merlin 600, 620 and 621	1,725 h.p. at 3,000 r.p.m.	1,770 h.p. at 3,000 r.p.m at 4,000 ft. (1,220 m.) and 1,655 h.p. at 3,000 r.p.m. at 16,500 ft. (5,030 m.)	—	1,160 h.p. at 2,650 r.p.m. at 10,000 ft. (3,050 m.) and 1,160 h.p. at 2,850 r.p.m. at 23,500 ft. (7,170 m.)	1,700 lbs. (772 kg.) (Merlin 620) 1,740 lbs. (790 kg.) (Merlin 620 and 621)	.4707 : 1 (Merlin 620) .420 : 1 (Merlin 600 and 621)	Two-speed two-stage supercharger. Intercooled. Charge heater. R.R. S.U. fuel injection pump. R.R. accessory gear-box. Electric starter.
Merlin 622 623, 624, 625 and 626	1,760 h.p. at 3,000 r.p.m.	1,810 h.p. at 3,000 r.p.m. at 3,750 ft. (1,145 m.)	—	1,500 h.p. at 2,850 r.p.m. at 7,750 ft. and 1,420 h.p. at 2,850 r.p.m. at 18,700 ft.	Same as 620	for Merlin and 621	Take-off power quoted is at 68°C. charge temperature. Merlin 625 and 626 have full-depth intercooling.

top of each cylinder-block in seven bearings, driven by inclined shaft and bevel gears from wheelcase.

FUEL INJECTION SYSTEM (Merlin 620 and 621).—Fuel-injection system comprises gear-type pump supplying fuel to a five-plunger pump operated by swash-plate. Stroke and capacity pump are varied by alteration of the angle at which swash-plate operates. Swash-plate assumes a mean position after compensating for all variable determining fuel demand.

SUPERCHARGER.—Two-speed two-stage supercharger, change-speed mechanism of which is operated by oil pressure from scavenge system. Delivery pressure of supercharger is controlled by automatic servo-mechanism coupled through differential linkage to throttle so that opening of latter is controlled to suit boost-pressure.

IGNITION.—Two twelve-cylinder magnetos spigot-mounted, one on each side of wheelcase. Each driven by skew-gear from upper vertical drive-shaft through serrated flexible couplings. System fully screened and waterproofed.

LUBRICATION.—Dry sump system. One pressure and two scavenge gear type pumps. Pressure pump delivers high pressure oil from aircraft tank to crankshaft and big-end bearings via relief valve unit. High pressure oil is also delivered to constant-speed airscrew unit where its pressure is still further increased for operation of variable-pitch airscrew. Oil at lower pressure is delivered from relief valve unit to camshaft and rocker mechanism, to oil jets feeding airscrew reduction gears, to supercharger drive mechanism and to various other bearings and gears throughout engine. Used oil drains back to the lower half crankcase where it passes through filters to two scavenge pumps, one servicing each end of lower half. Scavenge pumps deliver used oil via two-speed supercharger gear change operating gear and throttles to an oil cooler and thence back to aircraft tank.

COOLANT SYSTEM.—Coolant employed is mixture of 70% water and 30% ethylene glycol or 55% water and 45% ethylene glycol. System similar to that described under Griffon.

INTERCOOLER SYSTEM.—System is generally similar to that described under Griffon.

CHARGE HEATER.—A charge heater is also incorporated integral with the intercooler header tank but separate from the intercooler cooling system. The function of the charge heater is to maintain the charge temperature above 45°C. and so prevent lead separation of the fuel when mixture temperature falls below critical temperature.

STARTING.—Electric starter. Auxiliary hand-turning gear with reduction ratio of 13.56 : 1 operates through portion of same gear-train as electric starter.

ACCESSORIES.—Provision is made for driving an auxiliary gear-box mounted on aircraft bulkhead. Following accessories for aircraft services are fitted to gear box:—vacuum-pump, compressor, dynamo and blower for cabin pressurisation. Necessary pipework is fitted on engine for employment of an automatic fire-extinguishing system and also a de-icing equipment for airscrew.

AIRSCREW DRIVE.—Single spur reduction gear, .42 : 1 ratio on Merlins 621, 623 and 624, and .471 : 1 ratio on Merlins 620 and 622. Reduction gear shaft on Merlin 621 and 623 is splined for British airscrews and takes either Rotol or D.H. airscrew. On Merlin 620, 622 and 634 shaft is designed to suit American airscrews and takes either Hamilton Standard or Curtiss Electric airscrew.

PERFORMANCE.—See Table.

AUSTRALIA

COMMONWEALTH

COMMONWEALTH AIRCRAFT CORPORATION, PTY. LTD.

HEAD OFFICE AND WORKS: LORIMER STREET, PORT MELBOURNE, VICTORIA.

Directors: See page 107.

The Commonwealth Aircraft Corporation, Pty. Ltd. was formed in 1936 under a scheme propounded by the Australian Government for the establishment of an aircraft industry to make Australia independent of overseas supplies.

Commonwealth began engine production in 1936 with a licence to build the Pratt & Whitney R-1340 Wasp engine, with which to power the Commonwealth Wirraway. Between 1939 and 1943 680 Wasp engines were produced, and these were supplemented by 870 Twin-Wasp engines which were built between 1941 and 1945.

Current Commonwealth Engine Division activity centres around continued production of the Nene turbojet, manufactured under licence from Rolls-Royce Limited, for installation in the Australian-built Vampire. Tooling and planning are well advanced for the manufacture of the Rolls-Royce Avon which is to power both the Australian-built Canberra and the Sabre.

The design and engineering staff of the Engine Division have designed and developed a new seven-cylinder radial engine known as the Cicada to power later production versions of the Commonwealth CA-22 Winjeel trainer. The prototype Cicada engine began its type-test in March, 1953, and production arrangements are now in hand.

THE COMMONWEALTH CICADA.

TYPE.—Seven-cylinder air-cooled radial.

CYLINDERS.—Bore and stroke 5¾ in. × 5 in. (136.5 mm. × 127 mm.). Capacity 795 cub. in. Compression ratio 6.7 to 1. Deep finned cast aluminium-alloy heads shrunk on to forged chrome-molybdenum steel barrels. Individually removable pressure type baffles.

PISTONS.—Full skirt type with flat heads machined from aluminium-alloy forgings. Three compression rings, a dual oil control ring and an oil scraper ring.

CONNECTING RODS.—Solid master rod with steel backed silver-lead bearing. Six articulated rods attached to master rod by knuckle pins.

CRANKSHAFT.—Two-piece single-throw crankshaft with splined telescopic joint at main bearing. Two torsional vibration dampers in each of the front and rear halves of crankshaft. Supported on three silver-lead bearings in main crankcase sections.

CRANKCASE.—Crankcase sections are machined from aluminium-alloy forgings and divided in the plane of the cylinders. The halves are held together with fitted through bolts and the cylinder flanges. Front half of the main crankcase has an integral valve tappet section. The front support plate is machined from cast aluminium-alloy and houses the front main bearing. The blower section, which is a magnesium alloy casting, is attached to the rear half of the front main crankcase and incorporates the engine mounting lugs.

SUPERCHARGER.—High-speed centrifugal supercharger, together with its gearing, is located in the blower section and is driven at ten times crankshaft speed. Gear train is driven by a spring clutch and runs on sleeve type bearings.

VALVE-GEAR.—Valve operating machanism is completely enclosed. Shelf mounted cam, rotating at ½ engine speed, drives overhead valves through tappets, push rods and rocker arms. Rockers are supported on fully floating sleeve type bearings and are housed in horns on the cylinder head.

INDUCTION SYSTEM.—Updraft system using Stromberg "Q" series injection type carburettor. Removable vaned induction elbow is provided between carburettor and supercharger entry in rear section.

FUEL GRADE.—100/130 octane.

IGNITION.—Two Scintilla VMN-7DF magnetos flange mounted on the rear section. Harness is situated at the front of the cylinders and is of the radio shielded type.

ACCESSORY DRIVES.—Accessories are all grouped on the cast magnesium alloy rear section. Mounting pads are provided for carburettor elbow, two (2) magnetos, starter motor fuel pump, generator, vacuum pump, hydraulic pump, air compressor, tachometer, propeller governor and oil pressure transmitter.

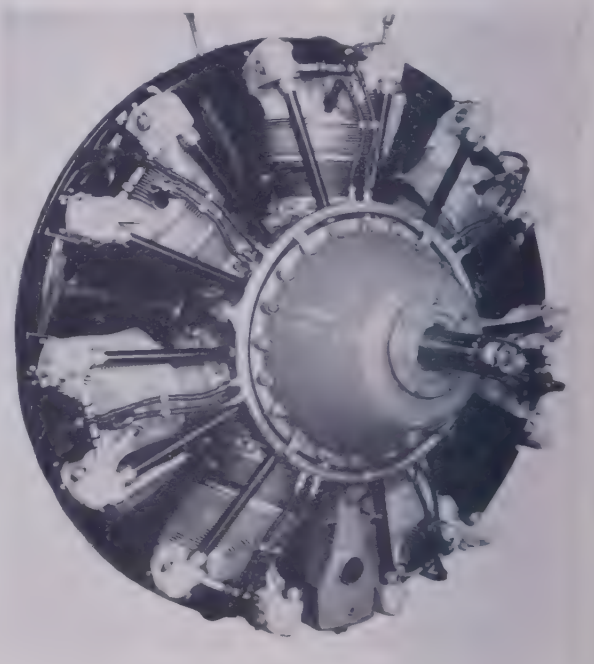
PROPELLER DRIVE.—Cast aluminium-alloy nose section houses the propeller shaft and reduction gear. An internal gear is attached to the propeller shaft flange and supported externally by means of a large roller race. The spur driving gear is attached to the crankshaft by means of splines. Propeller shaft size is SAE. 30 and is driven at $\frac{5}{10}$ crankshaft speed. Rotation clockwise from rear. Suitable for constant speed or hydromatic propeller.

LUBRICATION.—Forced lubrication is provided by means of a 3 section oil pump with 2 scavenge and one pressure relief stage. Cast magnesium sump is located between two bottom cylinders. Viscosity of oil 100 seconds.

DIMENSIONS.—
Overall diameter 46.5 in. (1,181 mm.).
Overall length 50.5 in. (1,283 mm.) over magnetos; 53 in. (1,346 mm.) over starter.

WEIGHT (Dry).—
770 lb. (350 kg.).

PERFORMANCE.—
Take-off rating 450 b.h.p. at 2,600 r.p.m.
Cruising output 300 b.h.p. at 2,350 r.p.m.



The 450 h.p. Commonwealth Cicada radial engine.

CZECHOSLOVAKIA

CESKOSLOVENSKÉ ZÁVODY AUTOMOBILOVÉ A LETECKÉ, (Czechoslovak Automobile and Aircraft Works).

HEAD OFFICE : KRIZIKOVA 38, PRAGUE X.

General Manager : F. Horák.

In this concern is grouped all the aviation industry including the factories producing aero-engines and airscrews.

The sale of all the aviation products as well as the information service are handled exclusively by :—

MOTOKOV LIMITED (Vehicle and Light Engineering Products Import and Export Company).

AVIATION SALES DEPARTMENT : TR. DUKEL HRDINU 27, PRAGUE VII.

THE WALTER MIKRON III.

The Walter Mikron III engine has been type-tested according to the international rules of ICAO, which call a total running time of 150 hours, 100 hours at full throttle.

TYPE.—Four-cylinder inverted in-line air-cooled, ungeared.

CYLINDERS.—Bore 99 mm. (3.54 in.). Stroke 96 mm. (3.78 in.). Total capacity 2.44 litres (149 cub. in.). Compression ratio 6 : 1. Steel cylinders with cooling fins machined from solid. Cylinder bores nitrided. Detachable cylinder-heads are aluminium-alloy castings. Cylinder-head assembly attached to the crankcase by four cylinder holding-down studs.

PISTONS.—Aluminium-alloy castings. Three compression rings and one scraper ring. Gudgeon-pins secured by spring circlips.

VALVE GEAR.—One inlet and one exhaust valve per cylinder, of special heat-resisting alloy steel with nitrided stems. Double valve springs. Valves operated by the camshaft through push-rods and rocker-arms. Rockers fitted with needle bearings, with rollers for the valves and valve-clearance adjusting-screws at the push-rod ends. Valve and rocker mechanism on each cylinder enclosed in Elektron cover.

CONNECTING RODS.—H-section, stamped from aluminium-alloy, polished. Split big-ends provided with steel-backed lead-bronze bearings.

CRANKSHAFT.—Forged from special chrome-vanadium steel, machined all over. Crank pins and journals nitrided. Carried in five steel-backed lead-bronze bearings and a ball thrust-bearing at the front end.

CRANKCASE.—Heat treated magnesium-alloy (Electron) casting.

LUBRICATION.—Dry-sump pressure lubrication. Double gear-type oil-pump with pressure and scavenge stages located at the rear of the crankcase above the sump. Oil drawn from oil tank by pressure pump, provided with an inlet and a pressure relief valve. Spent oil in sump withdrawn by scavenge pump and returned to oil tank. Union in the pressure line on the crankcase is adapted for pressure-gauge connection. The valve-gear works in an oil bath in each rocker cover box. The lubrication system can be modified on request for aerobatic flying, mainly by the addition of an automatic valve to the scavenge line.

INDUCTION SYSTEM.—Walter AI-37-A down-draught carburettor with manual mixture control. Cast induction manifold, pre-heated by exhaust gases, fitted with a drain valve and, on request, with two priming jets. Fuel supplied to the carburettor by double diaphragm Walter 2M 50 fuel pump, fitted with a pressure-gauge connection.

IGNITION.—Two Scintilla Vertex magnetos, OAF 4R 401Z39 (port) and OAF 4R 601 Z39 (starboard) with automatic sparking advance-placed side-by-side in a hanging position on the crankcase. Starboard magneto provided with impulse unit. Sparking plugs 12×1.25 mm. (.5×.07 in.).

COOLING.—Air scoop with an easily removable sliding inspection strip for access to the sparking plugs fitted on port side, with cylinder baffles on starboard side.

STARTING.—Hand-starter type Walter R15, with crank, supplied on request.

ACCESSORY DRIVES AND EQUIPMENT.—At the rear end of the crankcase. On left-hand side a tachometer drive, D. of R. clockwise, 1/2 engine speed, on right-hand side a fuel-pump mounting-flange and drive, D. of R. clockwise, 1/2 engine speed.

ENGINE MOUNTING.—Engine mounted elastically by means of four engine-bearer feet with rubber vibration dampers.

AIRSCREW DRIVE.—Direct, left-hand tractor (when looking at the engine from the rear). Boss for fixed-pitch airscrew normally used. Keyed to the tapered crankshaft front end and retained by a nut. Airscrew hub fixed to the boss by means of a retaining plate and six retaining bolts.

DIMENSIONS.—
- Overall length with airscrew boss 925 mm. (36.42 in.).
- Overall width without bearer feet 350.7 mm. (13.8 in.).
- Overall height 530 mm. (20.87 in.).

WEIGHT DRY (including normal accessories).—62 kg. (137 lb.).

PERFORMANCE.—
- Rated output at sea level 65 b.h.p. at 2,600 r.p.m.
- Cruising output 48 b.h.p. at 3,250 r.p.m.
- Fuel consumption at rated sea level power 245 gr. (.54 lb.) per h.p./hr.
- Fuel consumption at cruising power 225 gr. (.49 lb.) per h.p./hr.
- Oil consumption 2-8 gr./h.p./hr. (.0044-.018 lb.) per h.p./hr.

THE WALTER MINOR 4-III.

The Walter Minor 4-III engine has been type-tested according to the international rules of ICAO, 200 hours running time, 100 hours of which at full throttle and 50 hours special tests.

TYPE.—Four-cylinder inverted in-line air-cooled, ungeared.

CYLINDERS.—Bore 105 mm. (4.13 in.). Stroke 115 mm. (4.53 in.). Total capacity 3.98 litres (247.87 cub. in.). Compression ratio 6 : 1. Steel cylinders with cooling fins machined from solid. Cylinder bores nitrided. Detachable cylinder-heads are aluminium-alloy castings. Cylinder and head assembly attached to crankcase by four cylinder holding-down studs.

PISTONS.—Aluminium-alloy stampings. Three compression rings and one scraper ring. Gudgeon-pins secured by spring-circlips.

VALVE GEAR.—Same as for Mikron III.

CONNECTING RODS.—H-section, stamped from aluminium-alloy, polished. Split big-ends provided with steel-backed lead-bronze bearings.

CRANKSHAFT.—Forged from special chrome-vanadium steel, machined all over. Crank-pins and journals nitrided. Carried in five steel-backed lead-bronze bearings and a ball thrust-bearing at the front end.

CRANKCASE.—Heat-treated magnesium-alloy casting.

LUBRICATION.—Dry sump pressure lubrication. For description see Mikron III.

INDUCTION SYSTEM.—Walter 45 down-draught carburettor with manual mixture control. acceleration pump, special jet for inverted flight and choke. Cast induction manifold, pre-heated by exhaust gases, fitted with two priming jets and with 4 drain valves. A hot and cold air intake controllable from the cockpit, fitted on special request. Cold air passes directly to the carburettor, warm air is drawn from the cylinders through a flame trap. Fuel supplied to the carburettor by double diaphragm Walter 2M 50 fuel-pump fitted with a pressure-gauge connection.

IGNITION.—Dual non-shielded ignition; shielded ignition optional. Two Scintilla Vertex magnetos OAF 4R 401 Z39 (port) and OAF 4R 601 Z39 (starboard) with automatic sparking advance. Magnetos placed side-by-side in a hanging position at the rear of the crankcase. Starboard magneto provided with impulse unit. Sparking plugs 12×1.25 mm.

COOLING.—Cylinder cooling air-scoop and baffle plates as for Mikron III.

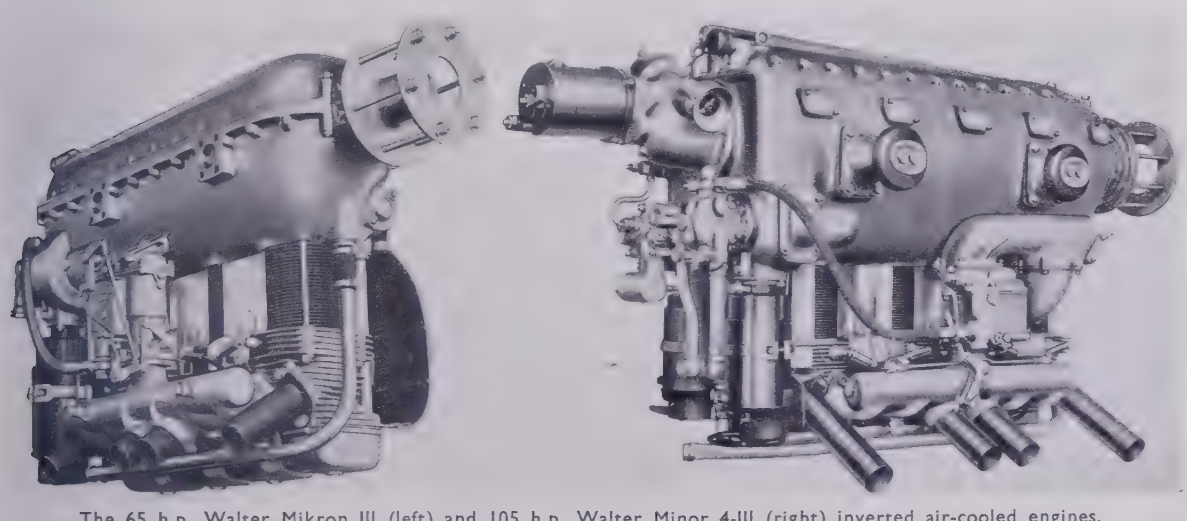
STARTING.—Electric and hand starter with crank, type Walter RE 25, or electric starter Walter P320, both supplied on request.

ACCESSORY DRIVES AND EQUIPMENT.—On the rear end of the crankcase; left-hand a tachometer drive (D. of R. clockwise, 1/2 engine speed); right-hand a fuel-pump mounting-flange and drive (D. of R. clockwise, 1/2 engine speed). On the port side of the crankcase can be fitted either a directly-driven 24-volt 300 watt. generator, or a flexible shaft for a remotely-driven generator; to the starboard flange a flexible shaft for a second generator can be fitted.

MOUNTING.—Four engine bearer feet with rubber vibration dampers, supplied on special request.

AIRSCREW DRIVE.—Direct, left-hand tractor (when looking at the engine from the rear). Boss for wooden fixed-pitch airscrew is normally used. Keyed to the tapered crankshaft front-end and retained by a nut. Airscrew hub attached to boss by retaining plate and eight retaining bolts. VP-airscrew Walter V401 mechanically operated or Walter V401E electrically operated, both optional.

DIMENSIONS.—
- Overall length with airscrew boss 1,032 mm. (40.63 in.).



The 65 h.p. Walter Mikron III (left) and 105 h.p. Walter Minor 4-III (right) inverted air-cooled engines.

Overall width without bearer feet 399 mm. (15.7 in.).
Overall height 632 mm. (24.9 in.).
WEIGHT DRY (including normal accessories).—90.3 kg. (199 lb.).
PERFORMANCE.
Rated output at sea level 105 b.h.p. at 2,500 r.p.m.
Cruising output 80 b.h.p. at 2,300 r.p.m.
Fuel consumption at rated sea level power 245 gr. (.54 lb.) per h.p./hr.
Fuel consumption at cruising power 225 gr. (.49 lb.) per h.p./hr.
Oil consumption 2-8 gr. (.0044-.018 lb.) per h.p./hr.

THE WALTER MINOR 6-III.

The Walter Minor 6-III engine has been type-tested according to the international rules of ICAO, 200 hours running time, 100 hours of which at full throttle, and 50 hours special tests.

All the construction of the Walter Minor 6-III engine is identical to the Walter Minor 4-III, except the following parts and specifications.

TYPE.—Six-cylinder inverted in-line air-cooled, ungeared.

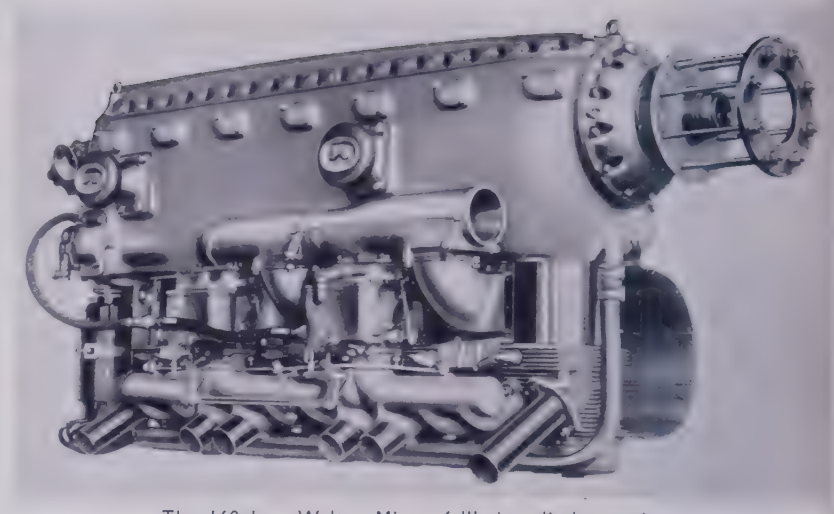
CYLINDERS.—Bore 105 mm. (4.13 in.). Stroke 115 mm. (4.53 in.). Total capacity 5.97 litres (364.3 cub. in.). Compression ratio 6 : 1.

CRANKSHAFT.—Carried in seven steel backed lead-bronze bearings and in a ball thrust bearing at the front end.

INDUCTION SYSTEM.—Two Walter 45 down-draught carburettors with manual mixture control, an acceleration pump, a special jet for inverted flight and a choke. Cast induction manifold of two parts, pre-heated by exhaust gases and fitted with two priming jets and with 6 drain valves. Hot and cold air intakes, controllable from the cockpit, fitted on special request. Cold air passes directly to the carburettors, warm air drawn from the cylinders through flame traps. Fuel supplied to the carburettors by a Walter 2M 50 double-diaphragm fuel pump, fitted with pressure-gauge connection.

IGNITION.—Dual non-shielded ignition: shielded ignition optional. Two Scintilla Vertex magnetos, OAF 6R 401 Z39 (port) and OAF 6R 601 Z39 (starboard), with automatic sparking advance. Magnetos placed side-by-side in a hanging position at the rear of the crankcase. Starboard magneto provided with an impulse unit. Sparking-plugs 12 × 1.25 mm.

DIMENSIONS.—
Overall length with airscrew boss 1,344 mm. (52.9 in.).



The 160 h.p. Walter Minor 6-III six-cylinder engine.

Overall width without bearer feet 399 mm (15.7 in.).
Overall height 639 mm. (25.16 in.).
WEIGHT DRY (including normal accessories).—126.8 kg. (280 lb.).
PERFORMANCE.—
Rated output at sea level 160 b.h.p. at 2,500 r.p.m.
Cruising output 120 b.h.p. at 2,300 r.p.m.
Fuel consumption at rated power 245 gr. (.54 lb.) per h.p./hr.
Fuel consumption at cruising power 225 gr. (.49 lb.) per h.p./hr.
Oil consumption 2-8 gr. (.0044-.018 lb.) per h.p./hr.

FRANCE

ARSENAL (See S.F.E.C.M.A.S.)

LUTETIA

MOTEURS LUTETIA.

Office and Works: 31, Boulevard de Courbevoie, Neuilly-sur-Seine.

M. Marcel Echard, who has specialised in the two-stroke motor (he built his first two-stroke aero engine in 1911), has since 1949 devoted his attention to the production of a light power-plant suitable for the amateur constructor, and for use in light touring and training aircraft. This engine, the Lutetia 4.C.02, has successfully passed its homologation trials at the S.T.Ae. and has been flight tested in a Bébé-Jodel light monoplane.

M. Echard is now developing a two-stroke radial engine with six double cylinders equally disposed round the crankcase. This engine will have an output of 70 h.p. at 2,600 r.p.m.

THE LUTETIA 4.C.02.

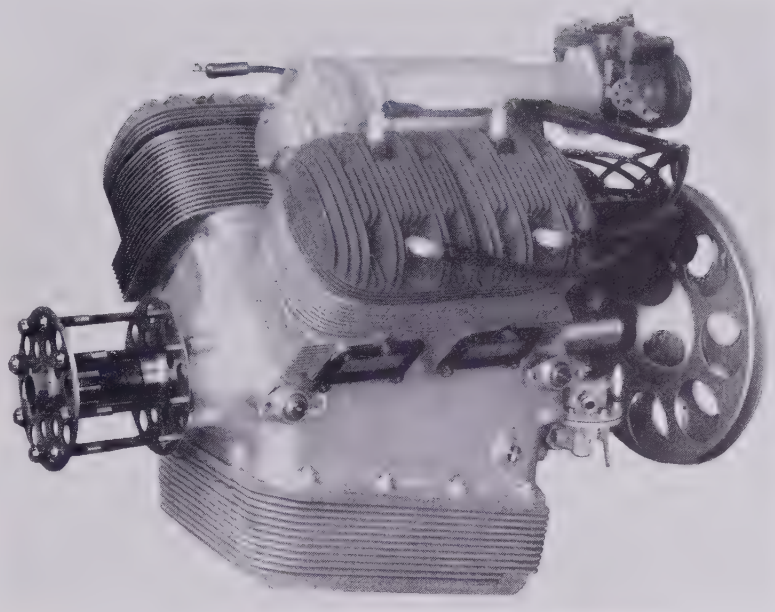
Type.—Four-cylinder 90° Vee air-cooled two-stroke.

Cylinders.—Bore 76 mm. (3.0 in.). Stroke 70 mm. (2.75 in.). Swept volume 1.267 litres. Compression ratio 7.2. Cylinder barrels with integral finning cast in pairs and bolted to crankcase.

Crankcase.—Light metal casting. Rear cover carries accessories. Lower cover forms oil reservoir and radiator.

Carburation.—Normal carburetter feeds into a volumetric compressor, mounted in the cylinder Vee, which in turn feeds mixture through inlet ports in cylinder walls, thus eliminating crankcase compression.

Lubrication.—Normal pressure type, by buried gear pump in crankcase sump which forms oil reservoir. Sump is finned externally for cooling.



The 44 h.p. Lutetia 4.C.02 four-cylinder two-stroke engine.

Ignition.—Dual magneto. Two plugs per cylinder.

Starting.—Automatic hand-starter.

Dimensions.—
Overall width 494 mm. (19.4 in.).
Overall length 647.5 mm. (25.5 in.).
Overall height 518 mm. (20.4 in.).

Weight Dry.—
46 kg. (101.2 lb.).

Performance.—
Take-off and max. continuous output 44 h.p. at 2,800 r.p.m.
Cruising output 31 h.p. at 2,500 r.p.m.

Fuel Consumptions.—
At max. continuous output 325 gr./h.p./hr. (0.71 lb./h.p./hr.).
Cruising 280 gr./h.p./hr. (0.5 lb./h.p./hr.)

MINIÉ

ETABLISSEMENTS VICTOR MINIÉ AERONAUTIQUE.

Head Office and Works: 9, Place des Teynes, Paris (17e).

This company, which specialises in the casting of light alloys, began the development of light aero-engines before the War. A feature of the three engines in production before the war, all four-cylinder horizontally-opposed, was that the cylinders and heads were cast in pairs. Only one engine with this feature, the 4.D4, was produced after the war and this model is no longer in production.

The present series of engines includes the 4.DF.28 rated at 65 h.p. at 2,450 r.p.m., the 4.DC.32, rated at 80 h.p. at 2,610 r.p.m., and the 4.DG.00 rated at 90 h.p. at 2,250 r.p.m. All three engines have conventional separate cylinders and heads.

THE MINIÉ 4.DF.28.

The 4.DF.28 is an air-cooled flat-four which except for a slightly reduced cylinder bore is similar to the 4.DC.32. It has been type-tested under I.C.A.O. conditions.

Type.—Four-cylinder horizontally-opposed air-cooled.

Cylinders.—Bore 100 mm. (3.9 in.). Stroke 91.5 mm. (3.6 in.). Capacity 2.8 litres.

Dimensions.—
Length overall 742 mm. (28.3 in.).
Overall height 451 mm. (17.75 in.).
Overall width 837 mm. (32.9 in.).

Weight Dry.—
89 kg. (196 lb.).

Performance.—
Normal rated output 65 h.p. at 2,450 r.p.m.

THE MINIÉ 4.DG.00.

This engine, also a flat-four, is characterised by having hemispherical cylinder heads and electrical equipment identical to that used by automobile engines.

Type.—Four-cylinder horizontally-opposed air-cooled.

Cylinders.—Bore 115 mm. (4.5 in.). Stroke 96 mm. (3.8 in.). Capacity 4 litres.

Dimensions.—
Overall length 972 mm. (38.2 in.).
Overall height 645 mm. (25.4 in.).
Overall width 820 mm. (32.3 in.).

Weight Dry.—
102 kg. (224 lb.).

Performance.—
Normal rated output 90 h.p. at 2,250 r.p.m.

THE MINIÉ 4.DC.32.

Type.—Four-cylinder horizontally-opposed air-cooled.

Cylinders.—Bore 102 mm. (4.02 in.). Stroke 91.5 mm. (3.6 in.). Capacity 2.98 litres (181.7 cub. in.). Compression ratio 7 : 1. Nickel-chrome steel barrels and light alloy heads shrunk on.

Pistons.—Light alloy castings. Three compression and one scraper rings.

Connecting Rods.—Forgings of nickel-chrome steel. Bronze small-ends. Roller-bearings at big-ends.

Crankshaft.—Special chrome-nickel steel forging running on three bearings, ball-bearing fore and aft and a roller bearing in the centre.

Crankcase.—Of light alloy, in four parts. Upper and lower sections together form the main barrel which carries the four cylinders and the three crankshaft bearings. The lower section also encloses the camshafts and carries the oil pump. The rear section closes the barrel and carries the drives for the magneto, fuel pump, etc. An oil sump mounted below the lower section, carries on its rear wall the carburettor. The induction pipe passes through the oil sump.

Valve Gear.—One inlet and one exhaust valve per cylinder. Carbon steel camshafts in lower section of crankcase operate valves through push-rods, rocker-arms and tappets. Double return springs. Totally enclosed valve-gear.

Induction.—One Zenith 42 H.M. 324.B carburetter mounted on back of crankcase oil-sump. Single induction pipe each side branches at inlet valves.

Ignition.—One R.B. Type J4 double magneto mounted on rear section of crankcase. Two plugs per cylinder.

Fuel Grade.—80 Octane.

Lubrication.—Wet sump. Circulation of oil ensured by single gear pump.

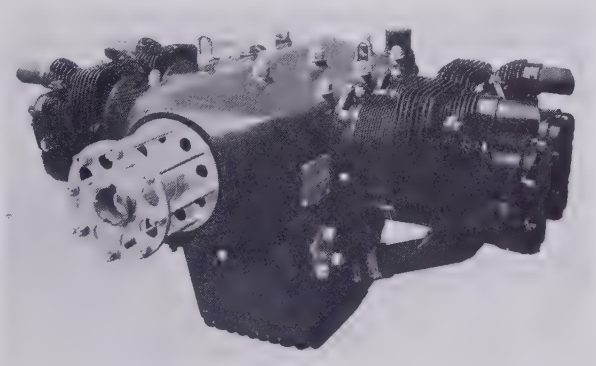
Starter.—Air-Equipement Type 50.450 hand inertia starter.

Mounting.—By four on lower half of crankcase for normal bearer mounting.

Dimensions.—
Length overall, including airscrew shaft 791 mm. (31.1 in.).
Overall height, including oil sump 431 mm. (16.9 in.).
Overall width 860 mm. (34.0 in.).

Weight Dry. –85.5 kg. (171 lb.).

Performance.—
Take-off output 80 h.p. at 2,610 r.p.m.
Normal output 75 h.p. at 2,575 r.p.m.



The 80 h.p. Minié 4.DC.32 flat-four engine.

POTEZ

SOCIÉTÉ DES AVIONS ET MOTEURS HENRY POTEZ.

HEAD OFFICE : 46, AVENUE KLÉBER, PARIS (XVIe).

EXPERIMENTAL LABORATORY (DESIGN AND DEVELOPMENT) : 37 RUE JEAN-JACQUES ROUSSEAU, SURESNES (SEINE), PRODUCTION FACTORY : 204 RUE HENRI BARBUSSE, ARGENTEUIL (SEINE-ET-OISE).

Based on the designs and development work of its long-established Engine Design Laboratory (L.E.M.), the Société des Moteurs Henry Potez is producing aircraft piston engines with new facilities at Argenteuil, in North-west Paris.

Production is being concentrated on the Potez 6.D-02 engine which has been selected, after exhaustive trials, to power the new programme training aircraft. The 6.D-02 is one of a range of four, six, and eight cylinder engines which are the outcome of a programme introduced before the war. All engines use the same basic cylinder of 125 mm. × 120 mm. (4.92 in. × 4.72 in.) and all but the 8.D-40 which is still in the design stage, have been type-tested and extensively flight-tested. Direct injection has been introduced with Type 6-D-30.

THE POTEZ 4-D 01.

TYPE.—Four-cylinder in-line inverted, air-cooled.

CYLINDERS.—Bore 125 mm. (4.92 in.). Stroke 120 mm. (4.72 in.). Swept volume 5.85 litres (352 cub. in.). Compression ratio 7 : 1. Nitrided steel cylinder barrel with Y alloy die-cast cylinder heads secured by four long bolts screwing into crankcase.

PISTONS.—Y alloy die forgings. Two compression and one double scraper above gudgeon-pin, one scraper ring below. Floating gudgeon-pin.

CONNECTING ROD.—I-section aluminium-alloy forgings with split big-ends and split steel-backed lead-bronze lead-plated bearings. Assembly by four chrome-nickel steel bolts. Little-end floating directly on gudgeon-pin.

CRANKSHAFT.—Nickel - chrome - molybdenum steel, forged and machined. Four-throw, on six bearings. Deep-groove ball-bearing at front, remainder are steel-backed lead-bronze lead-lined. Solid splined airscrew shaft.

CRANKCASE. — Aluminium - alloy casting with duralumin top cover. Five duralumin forged bearing caps secured by chrome-nickel steel studs. Chrome-nickel steel through-bolts at centre bearing cap. Cast magnesium-alloy oil sump in rear section of case.

VALVE GEAR.—Two symetrically-inclined valves of nitrided austenitic steel per cylinder. Stellited sodium-cooled exhaust valves. Tin-silicon-cupro-nickel shrunk-in valve-seats. Single camshaft in crankcase operates all valves through roller tappets, push-rods and adjustable rocker-arms. Two shot-peened vanadium steel valve springs per cylinder.

INDUCTION.—One Zenith inverted 60 IDC.04 carburettor with automatic altitude control. Exhaust-heated muff on induction pipe. Pressure feed by one A.M. pump, type CM12.

FUEL.—80 Octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

IGNITION.—One double RB type J4A magneto. BG screened harness and two BG type 401 MN spark-plugs per cylinder. Potez patented automatic spark advance linked with throttle.

LUBRICATION.—Dry sump type. One pressure and two scavenge pumps, fore and aft. Normal oil pressure 3.5-5.0 kg./cm.² (49.7-71.0 lb./sq. in.). Minimum temperature 50°C. Maximum temperature 95°C. at inlet. 100°C. at outlet.

AIRSCREW DRIVE.—Direct, right-hand drive. Splines conforming to B.N.Aé. 212.01. Provision for electric or hydraulic variable-pitch airscrew.

ACCESSORIES.—Drive for 24-volt 600-watt electric generator on left rear side of crankcase. Ratio 2.48 : 1. Tachometer drive on rear of crankcase. Ratio 1 : 2. Vacuum pumps and hydraulic pump drives on rear of sump case. Ratios : 1.06 : 1 and 0.67 : 1 respectively.

STARTER.—Potez electric 24-volt direct drive starter.

MOUNTING.—Three-point flexible mountings, one on each side of crankcase on C.G. and one aft.

COOLING.—Three inter-cylinder deflectors, one rear deflector, and one side chute in two pieces, one movable. Maximum temperatures (at 2,400 r.p.m.) 250°C. cylinder heads, 140°C. cylinder barrels.

DIMENSIONS.
Overall length 1,207.5 mm. (47.5 in.).
Overall height 668.5 mm. (26.3 in.).
Overall width 510 mm. (20.1 in.).

WEIGHT DRY (without accessories).—143 kg. (314.6 lb.).
Weight of accessories mentioned 18.7 kg. (41.2 lb.).

PERFORMANCE.—
Take-off output 160 h.p. at 2,520 r.p.m.
Normal output at sea level 155 h.p. at 2,500 r.p.m.
Max. cruising output 130 h.p. at 2,360 r.p.m.
Economic cruising output 105 h.p. at 2,260 r.p.m.

CONSUMPTIONS.—
At take-off 245 gr./h.p./hour, at normal output (2,500 r.p.m.) 240 gr./h.p./hour.
At max. cruising 215 gr./h.p./hour.
At economical cruising 205 gr./h.p./hour.

THE POTEZ 4-D 31.

This is the previously-described 4-D 01 fitted with a centrifugal blower mounted horizontally on the crankcase top-cover.

The general description of the 4-D 01 applies to this engine except for the following details :—

CYLINDERS.—Same as for 4-D 01. Cylinder head shrunk on sleeve.

INDUCTION.—Supercharged. Sealed carburettor and pressure pump as for 4-D 01.

SUPERCHARGER. — Single - stage centrifugal type. High-strength die-forged aluminum-alloy impeller driven from front end of crankshaft through ground spur teeth, ground zerol bevel gearing and slipping coupling. Ratio 14 : 1.

FUEL.—91 Octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

LUBRICATION.—Same as for 4-D 01. Pressure feed to supercharger drive.

DIMENSIONS.—
As for 4.D 01 except overall height 720 mm. (28.4 in.).

WEIGHT DRY (without accessories).—166 kg. (365 lb.).

PERFORMANCE.—
Take-off output 220 h.p. at 2,600 r.p.m.
Normal output 200 h.p. at 2,500 r.p.m.
Max. cruising output 160 h.p. at 2,320 r.p.m.
Economic cruising output 140 h.p. at 2,220 r.p.m.

CONSUMPTIONS.—
At take-off 270 gr./h.p./hour.
At normal output 260 gr./h.p./hour.
At max. cruising 225 gr./h.p./hour.
At economical cruising 215 gr./h.p./hour.

THE POTEZ 6-D 02.

TYPE.—Six-cylinder in-line inverted air-cooled.

CYLINDERS.—Same as for 4-D 01 except swept volume 8.83 litres (539 cub. in.).

PISTONS AND CONNECTING RODS.—Same as for 4-D 01.

CRANKSHAFT.—Six-throw, nitrided nickel-chrome-molybdenum steel, forged and machined all over. Deep-groove ball thrust bearing and seven steel-back lead-bronze lead-plated bearings. Solid splined airscrew shaft.

CRANKCASE.—Aluminium-alloy casting with dural flat top cover. Seven dural forged bearing caps secured by two and four chrome-nickel steel studs. Chrome-nickel steel through-bolts at three centre bearing caps. Seven camshaft journals. Cast magnesium-alloy oil sump in rear section of case.

VALVE GEAR.—Same as for 4-D 01.

INDUCTION. —Normally aspirated. Two Hobson A.I. 55/J carburettors with automatic altitude correction and enrichment. Fuel feed by AM Type CM 13 pump. Provision for aerobatics.

FUEL.—80 Octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

IGNITION.—Fully VHF screened. One double RB Type J6A magneto. BG harness and two BG 401 MN spark-plugs per cylinder. Potez patented automatic spark advance linked with throttle.

LUBRICATION.—Same as for 4-D 01. Provision for scavenging of crankcase in inverted flight by gravity-sensitive dual valve.

AIRSCREW DRIVE.—Direct, right-hand drive. Splines conforming to B.N.Ae. 212.01. Provision for hydraulic variable-pitch airscrew.

ACCESSORIES.—Drive for 24-volt 1,600-watt electric generator on left rear side of crankcase. Ratio 2.46 : 1. Tachometer drive on rear of crankcase. Ratio 0.5 : 1. Vacuum and hydraulic pump drives on rear of sump case. Ratios 1.07 : 1 and 0.67 : 1 respectively. Hydraulic airscrew regulator on right front side of crankcase. Ratio 0.5 : 1.

STARTING. — Potez electric 24-volt direct starter.

MOUNTING.—Four points, two forward and two aft of C.G.

COOLING.—Five inter-cylinder deflectors, one rear deflector and one side chute in two pieces, one movable. Maximum temperatures (at 2,500 r.p.m.) 250°C. cylinder heads, 150°C. cylinder barrels.

DIMENSIONS.—
Overall length 1,550 mm. (61 in.).
Overall height 668.5 mm. (26.3 in.).
Overall width 510 mm. (20.1 in.).

WEIGHT DRY.—
Without accessories 235 kg. (517 lb.).
Weight of accessories mentioned 17 kg. (37.4 lb.).

POWER RATING.
Take-off output 240 h.p. at 2,530 r.p.m.
Normal output at sea level 230 h.p. at 2,500 r.p.m.
Max. cruising output 180 h.p. at 2,300 r.p.m.
Economic cruising output 135 h.p. at 2,100 r.p.m.

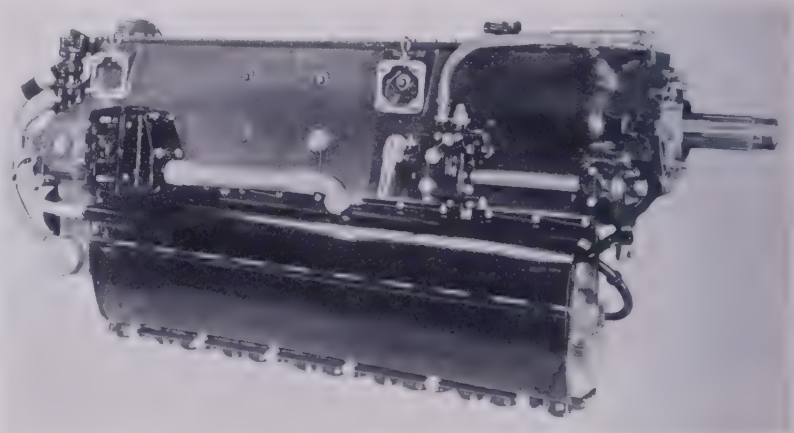
CONSUMPTIONS.
At take-off 250 gr./h.p./hour.
At normal output (2,500 r.p.m.) 240 gr./h.p./hour.
At max. cruising 220 gr./h.p./hour.
At economical cruising 205 gr./h.p./hour.

THE POTEZ 6-D 30.

This is the above-described 6-D 02 fitted with a centrifugal blower mounted horizontally on the crankcase top-cover. The description of the 6-D 02 applies to this engine except for the following details :—

CYLINDERS.—Same as for 6-D 02. Cylinder-head shrunk-fitted on sleeve.

INDUCTION. — Supercharged. Direct high pressure injection into cylinder head



The 240 h.p. Potez 6.D-02 six-cylinder inverted engine.

provided by Bronzavia swash-plate six-plunger pump Type 130-604 supported by crankcase at front right side and driven at camshaft speed by bevel gearing. Fully-automatic mixture control with automatic altitude and temperature controls. One injection nozzle per cylinder. No boost control. One throttle valve at supercharger outlet. First-stage fuel pump incorporated into injection pump.

SUPERCHARGER.—Same type as for 4-D 31. Ratio 14.07 : 1.

FUEL.—91 Octane minimum. Up to 1.2 cc.'s of lead per litre accepted by engine.

LUBRICATION.—Same as for 6-D 02. Pressure feed to supercharger drive.

ACCESSORIES.—Drive for 24-volt 1,600 watt electric generator on left rearside of crankcase. Ratio 2.46 : 1. Tachometer drive on rear of crankcase. Ratio 0.5 : 1. Vacuum pump drive on rear of sump case. Ratio 1.07 : 1. Hydraulic pump drive on rear of crankcase. Ratio 0.5 : 1. Hydraulic airscrew regulator at rear of sump case. Ratio 0.67 : 1.

COOLING.—Same as for 6-D 02. Maximum temperatures (at 2,400 r.p.m.) 255°C. cylinder heads, 160°C. cylinder barrels.

DIMENSIONS.—
As for 6-D 02, except overall height 720 mm. (28 in.).

WEIGHT DRY.—
Without accessories 259.5 kg. (570 lb.).

POWER RATING.—
Take-off output 305 h.p. at 2,400 r.p.m.
Normal output 260 h.p. at 2,400 r.p.m.
Max. cruising output 200 h.p. at 2,200 r.p.m.
Economic cruising output 150 h.p. at 2,000 r.p.m.

CONSUMPTIONS.—
At take-off 300 gr./h.p./hour.
At normal output 270 gr./h.p./hour.
At max. cruising 230 gr./h.p./hour.
At economical cruising 215 gr./h.p./hour.

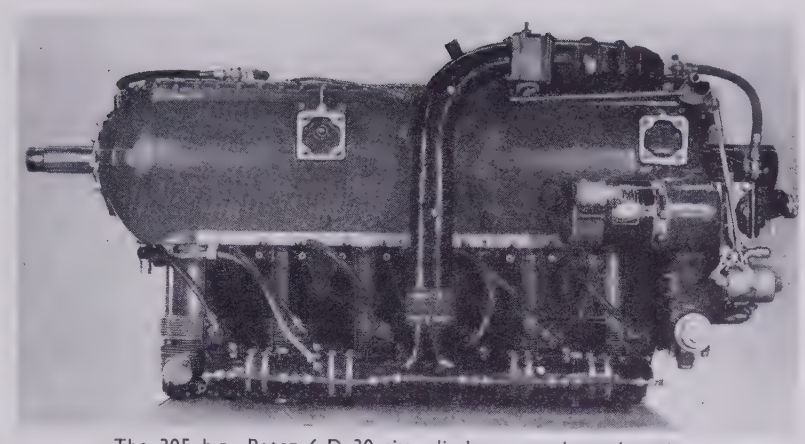
THE POTEZ 8-D 32.

TYPE.—Eight-cylinder 90° inverted Vee air-cooled, geared and supercharged.

CYLINDERS.—Same as for 4-D 01, except swept volume 11.78 litres (719 cub. in.).

PISTONS.—Same as for 4-D 01.

CONNECTING ROD.—Fork and blade type in nitrided nickel-chrome-molybdenum steel, with split big-ends and split steel-backed lead-bronze lead-plated bearings. Assembly by four chrome-nickel steel bolts in fork rod and two in blade rod.



The 305 h.p. Potez 6-D 30 six-cylinder supercharged engine.

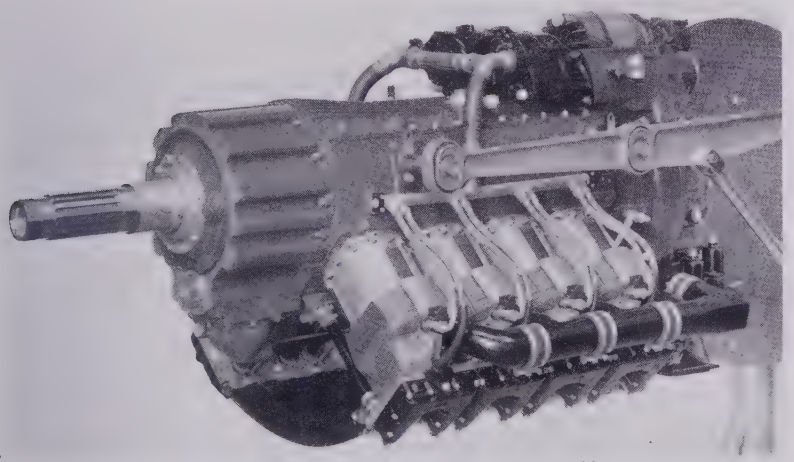
CRANKSHAFT.—Four-throw 90° dynamically-balanced one-piece shaft of nitrided nickel-chrome-molybdenum steel. Five split steel-backed lead-bronze lead-plated bearings. Drive to reduction gear and camshaft from serrated flange bolted to front end of shaft. On rear end is shrunk the flexible torsion shaft to the supercharger drive.

CRANKCASE.—Aluminium-alloy monobloc casting with cast magnesium-alloy ribbed top cover. Five dual forged bearing caps, three secured by four chrome-nickel steel studs, two by two studs. Chrome-nickel steel through-bolts of three centre bearing caps. Front of the crankcase closed by reduction-gear casing, rear end by supercharger casing and accessory support. Oil sump in rear portion of case and below compressor casing.

VALVE GEAR.—Same as for 4-D 01. Single camshaft in crankcase.

INDUCTION.—Supercharged. One Zenith 95 RGSL automatic carburettor with automatic altitude control and full throttle enrichment. Forced circulation of scavenge oil round intake elbow to blower. Fuel feed by A.M. pump type CM 13.

SUPERCHARGER.—Single-stage single-speed centrifugal supercharger. Ratio 8.75 : 1.



The 450 h.p. Potez 8.D-32 eight-cylinder inverted Vee engine.

FUEL.—91 Octane minimum. Up to 1.2 cc.'s per litre lead accepted by engine.

IGNITION.—Fully VHF screened. Two R.B. Type P8BA magnetos. Two BG Type 401 MN spark-plugs per cylinder. Potez patented automatic spark-advance linked with throttle.

LUBRICATION.—Dry sump type. Two pressure and three scavenge pumps. Oil pressure and temperature same as for 6-D 30.

REDUCTION GEAR.—Planetary type with seven satelites. Gear ratio 0.657 : 1.

AIRSCREW DRIVE.—Direct, right-hand drive. Airscrew shaft with 16 splines 73.3 × 67.7 × 7.4. Provision for electric or hydraulic variable pitch airscrew.

ACCESSORIES.—Drive for 24-volt 2,500-watt electric generator over supercharger casing. Ratio 2.27 : 1. Tachometer drive on right side of supercharger casing. Ratio 0.5 : 1. Vacuum pump on rear (right) of accessories support. Ratio 0.895 : 1. Hydraulic pump on rear (left) of accessories support. Ratio 1 : 1. Electric airscrew regulator. Ratio 0.5 : 1.

STARTING.—Potez 24-volt electric starter mounted in Vee of engine.

MOUNTING.—Four-point flexible mounting, two points forward and two aft of C.G.

COOLING.—Six inter-cylinder deflectors, one rear deflector and one under-scoop. Temperatures as for 6-D 30. This engine can be supplied as a pusher-type with incorporated stepped-up fan.

DIMENSIONS.—
Overall length 1,720 mm. (67.8 in.).
Overall width 794 mm. (31.3 in.).
Overall height 803 mm. (31.6 in.).

WEIGHT DRY.—
Without accessories 333.25 kg. (733 lb.).
Weight of accessories 24 kg. (52.8 lb.).
Weight of the fan 15 kg. (33 lb.).

POWER RATING.—
Take-off output 450 h.p. at 2,800 r.p.m.
Normal output (sea level) 370 h.p. at 2,700 r.p.m.
Normal output (2,350 m. = 7,700 ft.) 400 h.p. at 2,700 r.p.m.
Max. cruising output 340 h.p. at 2,560 r.p.m.
Economical cruising output 280 h.p. at 2,350 r.p.m.

CONSUMPTIONS.—
At take-off 250 gr./h.p./hour.
At normal output 270 gr./h.p./hour.
At max. cruising 215 gr./h.p./hour.
At economical cruising 210 gr./h.p./hour.

S.F.E.C.M.A.S.

SOCIÉTÉ FRANÇAISE D'ETUDES ET DE CONSTRUCTIONS DE MATÉRIELS AERONAUTIQUES SPECIAUX (S.F.E.C.M.A.S.).

HEAD OFFICE: 12, RUE BÉRANGER, CHATILLON-SOUS-BAGNEUX (SEINE).

This new private company results from the change of status from January 1, 1953, of the Arsenal de l'Aéronautique, which ceased to exist as a State-owned establishment on December 31, 1952.

Before the last war the Arsenal was entrusted with the design of a transmission system for transmitting power at distance. This work resulted in the production of a coupling which faithfully transmits the same angular speed from a driving to a driven shaft under conditions of misalignment. The purpose of this development was to offer to aircraft constructors the possibility of mounting engines in tandem. After the war the work was resumed and current development of the "constant-velocity" coupling is now to be found in the non-aeronautical field.

Immediately after the last war the Arsenal undertook the development, from the German Junkers Jumo 213, of both twelve and twenty-four cylinder aircraft engines. The 24H twenty-four cylinder engine which was rated at 4,000 h.p. has been described in previous editions of "All the World's Aircraft." The 12H engine, described hereafter, powers the Nord 1402 amphibian flying-boat which is now in production for the French Navy.

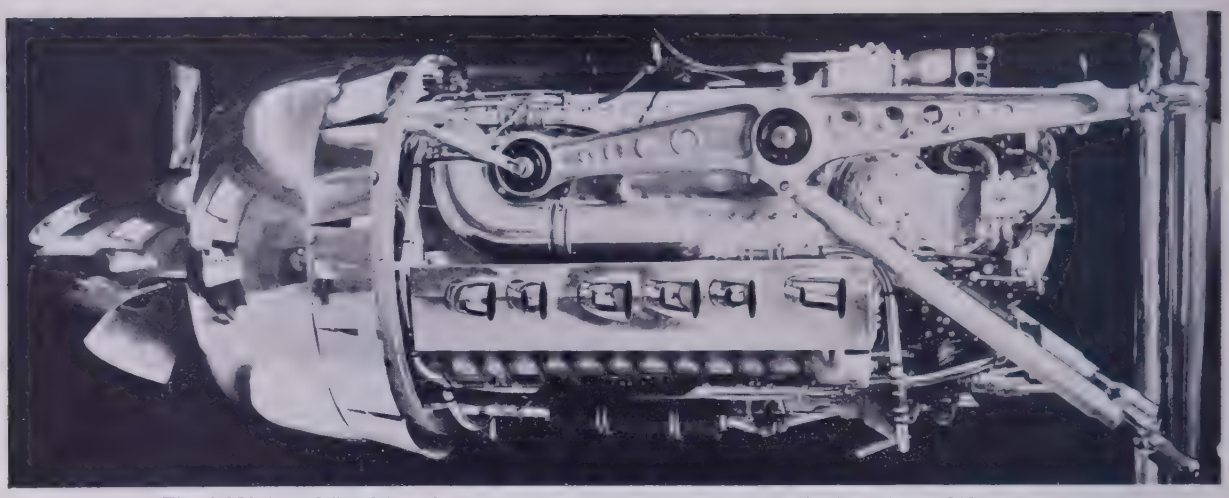
The S.F.E.C.M.A.S. is also developing and producing various types of ramjets, pulsejets and rocket motors for aircraft and guided missiles. Brief details of two ramjets will be found in Part I of this section.

THE S.F.E.C.M.A.S. 12H.

The 12H is an inverted Vee type engine with fuel injection and a low-pressure liquid cooling system. Two different reduction gears are available so that the engine may drive either a single airscrew or two contra-rotating airscrews.

TYPE.—Twelve-cylnder inverted 60° Vee liquid-cooled.

CYLINDERS.—Bore 150 mm. (5.9 in.). Stroke 165 mm. (6.5 in.). Displacement 35 litres



The 2,250 h.p. S.F.E.C.M.A.S 12H engine, a development of the Junkers Jumo 213 engine.

(2,136 cub. in.). Compression ratio 6.5 : 1. Cylinder blocks integral with crankcase. Steel cylinder liners. Detachable cylinder heads.

PISTONS.—Forged duralumin. Three compression, one oil control and one scraper rings.

CONNECTING RODS.—Each assembly consists of one main and one forked rod. the former of chrome and the latter of nickel-chrome molybdenum manganese alloy. Lead-bronze big-end bearings and little end bushings.

CRANKSHAFT. — Six - throw counterbalanced shaft running in seven lead-bronze bearings.

CRANKCASE.—Aluminium-alloy monobloc with integral cylinder blocks.

VALVE GEAR.—Two inlet and one exhaust valves per cylinder. Exhaust valves sodium-cooled and Brightray tipped. Valve seats shrunk in cylinder heads. Exhaust-valve seat stellited. Camshafts in cylinder heads.

INDUCTION.—Direct fuel injection system. Junkers type injection pump and open-type injectors.

SUPERCHARGER.—Two-speed centrifugal blower. Ratios : 6.85 : 1 and 9.38 : 1.

FUEL GRADE.—100 Octane.

IGNITION.—Two Bosch Z M12 CR8 magnetos. Two KLG or BG spark-plugs per cylinder. Fully-screened harness.

LUBRICATION.—One high-pressure and six auxiliary pumps.

AIRSCREW DRIVE.—Spur reduction gear.

ACCESSORIES.—All accessory mountings and drives on rear cover. Power take-off for auxiliary gear-box mounted on aircraft firewall.

STARTING.—Bosch AL/SGC 24DR2 inertia starter on rear cover.

DIMENSIONS.
Length 2.246 m. (87.6 in.).
Width 0.789 m. (31 in.).
Weight 1.173 m. (46.5 in.).

WEIGHT DRY.
1,002 kg. (2,209 lb.).

PERFORMANCE.
Take-off output 2,070 h.p. at 3,250 r.p.m.
Normal output (low blower) 1,720 h.p. at 3,000 r.p.m. at 1.800 m. (5,900 ft.).
Normal output (high blower) 1,620 h.p. at 3,000 r.p.m. at 5,000 m. (16,400 ft.).
Economical cruising output (low blower) 1,060 h.p. at 2,400 r.p.m. at 2,800 m. (9.180 ft.).
Cruising output (high blower) 1,000 h.p. at 2,400 r.p.m. at 5,200 m. (17,050 ft.).

CONSUMPTIONS (Cruising).—
Fuel 200 gr. (0.446 lb.) per h.p./hour.
Oil 4 gr. (0.144 oz.) per h.p./hour.

SNECMA.

SOCIÉTÉ NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION.

HEAD OFFICE : 150, BOULEVARD HAUSSMANN, PARIS 8E.

WORKS : PARIS (BOULEVARD KELLERMANN), GENNEVILLIERS (SEINE), BILLANCOURT (SEINE), SURESNES (SEINE) AND VILLAROCHE (SEINE-ET-MARNE).

President and Director-General : Henri Desbruères.

Administrative Director : M. Du Chazel.

Technical Director (Piston engines) : Raymond Marchal.

Technical Director (Gas Turbine engines) : H. Oestrich.

Director-Controller : Marcel Richer.

Director of External Relations : Gilbert Racine.

The Société Nationale d'Etude et de Construction de Moteurs d'Aviation. (SNECMA) is the successor to the Société de Moteurs Gnôme-et-Rhône which was nationalised in 1945. In 1946 Renault Aviation was incorporated in SNECMA.

The latest piston-engines developed since the war by SNECMA are the R.210 and 14X. The 14X.O2 passed its homologation tests in March, 1953.

SNEMCA continues to manufacture the Renault 12S and Regnier 4L in-line inverted air-cooled engines, and is building the Hercules 758 and 759 engines under licence from the Bristol Aeroplane Co., Ltd. It also continues to service and repair the Renault 4P and 6Q and Gnôme-Rhône 14N and 14M engines, which are no longer in production.

SNECMA is now devoting the major part of its activities to the development and series production of gas-turbine engines, for details of which see under "SNECMA" in Part I of this Section.

THE SNECMA R.210 SERIES.

TYPE.—Fourteen-cylinder two-row radial air-cooled, geared and supercharged.

CYLINDERS.—Bore 146 mm. (5.74 in.). Stroke 165 mm. (6.5 in.). Capacity 38.67 litres (2,358 cub. in.). Compression ratio 6.4. Steel barrels and aluminium-alloy heads. Two inclined valves per cylinder.

PISTONS. — Forged aluminium-alloy. Two compression and two scraper rings. Of the latter, one is above and one below the gudgeon pin.

CONNECTING RODS.—Two identical sets of rods, one for each bank of cylinders. Each consists of a single-piece master-rod and six auxiliary rods, all I-section nickel-chrome steel. Steel-backed white metal master-rod bearing. Auxiliary rods are bronze-bushed for both piston and knuckle pins.

CRANKSHAFT.—180° two-throw shaft in three-pieces. Shaft supported on two roller-bearings and ball thrust-bearing.

CRANKCASE.—Forged duralumin in three sections, the centre section carrying the fourteen cylinders, the front portion housing the timing gears and supporting the reduction-gear case, and the rear section housing the supercharger and its drives. A rear cover carries the accessories and their drives.

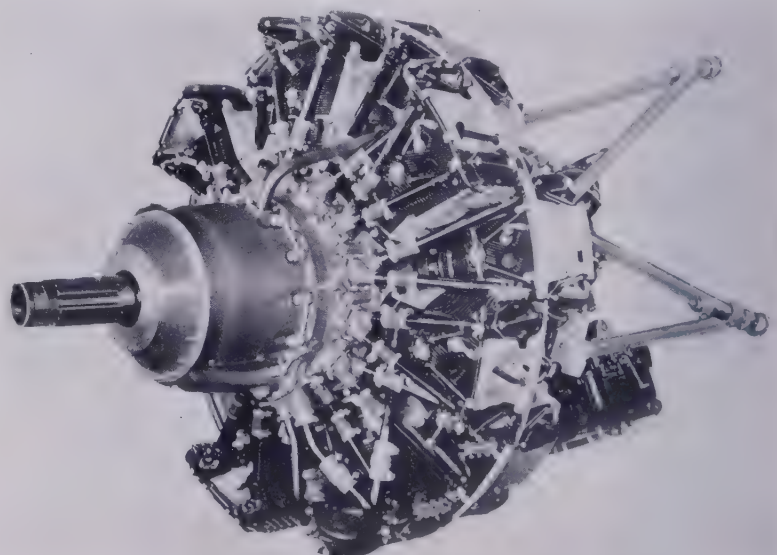
VALVE GEAR.—Two inclined valves per cylinder. Double-track cam-ring in forward section of crankcase operates valves through push-rods and rocker arms. Each valve has its separate operating mechanism, enclosed in oil-tight casings.

CARBURATION.—Bronzavia carburetter with automatic boost control.

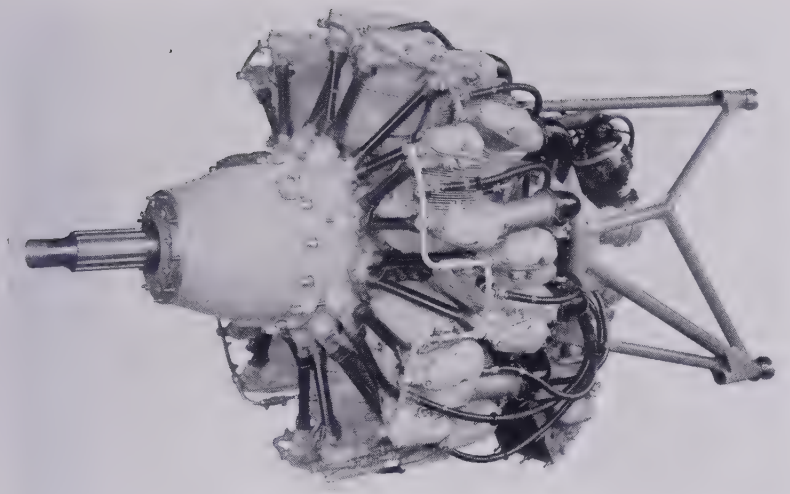
FUEL GRADE. —100/130.

SUPERCHARGER. — Centrifugal single-stage compressor driven off rear end of crankshaft through planetary gearing. Supercharger gear ratio 6.73.

IGNITION.—Two magnetos with automatic advance. Two plugs per cylinder. Fully-screened ignition system.



The 1,600 h.p SNECMA R.210 radial air-cooled engine.



The 820 h.p. SNECMA 14X.02 radial air-cooled engine.

LUBRICATION.—One pressure pump and one scavenge pump at the rear of the engine. Both these pumps may be driven by electric motor to ensure full circulation of oil throughout engine before starting. Two auxiliary scavenge pumps at front of engine. Hand-operated laminar oil-filter.
REDUCTION GEAR.—Planetary or epicyclic bevel reduction gear. Ratio 0.562 : 1.
STARTING.—Air-Equipement 50.960 electric starter.
ACCESSORIES.—All auxiliaries, including generator, hydraulic pump, vacuum pump, air compressor and tachometer drive mounted on rear cover. Drives taken off extension of crankshaft which drive the compressor.
DIMENSIONS.—
Diameter 1,284 mm. (50.5 in.).
Length 1,981 mm. (77.9 in.).
WEIGHT DRY.—
950 kg. (2,090 lb.).
PERFORMANCE.—
Take-off output 1,600 h.p. at 2,600 r.p.m. at 1,150 m. (3,700 ft.).
Max. continuous output 1,300 h.p. at 2,400 r.p.m. at 2,350 m. (7,600 ft.).
Max. cruise output 1,050 h.p. at 2,225 r.p.m. at 3,300 m. (10,800 ft.).

THE SNECMA 14X.

The 14X is a medium-powered engine which is being developed in two versions, the 14X.02 commercial model and the 14X.04 military model. The main differences between these two versions are concerned with output at sea level and at altitude, the military engine having a higher blower ratio.

The 14X 02 passed its homologation tests in March, 1953.

TYPE.—Fourteen-cylinder two-row radial air-cooled, geared and supercharged.
CYLINDERS.—Bore 122 mm. (4.80 in.). Stroke 116 mm. (4.56 in.). Capacity 19 litres (1,160 cub. in.). Compression ratio 6.8. Special steel cylinder barrels with light alloy fins. Aluminium-alloy cylinder heads screwed and shrunk on barrels. Two inclined valves per cylinder.
PISTONS.—Forged aluminium-alloy.
CONNECTING RODS.—Two identical sets of rods, each consisting of a master rod and six auxiliary rods.
CRANKSHAFT. — Three-piece nickel-chrome steel two-throw shaft supported on one lead-bronze and two roller-bearings.
CRANKCASE.—Forged aluminium-alloy in three sections, the centre portion carrying the cylinders, the front portion housing the timing gears and supporting the reduction gear case, and the rear section housing the supercharger. A rear cover carries the accessories and their drives.
CARBURATION.—Completely automatic Zenith carburettor with altitude correction and progressive enrichment control. Mixture fed to single-stage single-speed centrifugal supercharger and thence through fourteen tangential inlet pipes to cylinders. One rotary fuel pump and one automatic pressure-regulating valve.
FUEL GRADE.—100/130.
SUPERCHARGER. — Centrifugal single-stage single-speed compressor. Gear ratios 6.14 : 1 (14X.02), 7.65 : 1 (14X.04).
IGNITION.—Two magnetos with automatic advance. Two plugs per cylinder. Fully-screened ignition system.
LUBRICATION.—One pressure and one scavenge pump.
REDUCTION GEAR.—Epicyclic with conic satellite pinions. Ratio 1/2.
AIRSCREW ROTATION.—Anti-clockwise.
STARTING.—Air-Equipement 50.960 electric, direct-drive.
ACCESSORIES.—All grouped on rear cover. Includes a 20 h.p. drive for aircraft accessory gear-box.
DIMENSIONS.—
Length 1,619 mm. (63.6 in.).
Frontal area 0.80 m.² (8.6 sq. ft.).
WEIGHT (with magnetos, starter, carburettor, petrol pump, cylinder deflectors and mounting.—
595 kg. (1,310 lb.).
PERFORMANCE (14X.02).—
Take-off 820 h.p. at 3,100 r.p.m. at 900 m. (2,950 ft.).
Max. continuous 710 h.p. at 2,850 r.p.m. at 1,700 m. (5,580 ft.).
Max. cruise 550 h.p. at 2,700 r.p.m. at 3,000 m. (9,840 ft.).
CONSUMPTIONS.—
Fuel (cruising at 410 h.p.) 209 gr. (.46 lb.) per h.p./hr.
Oil (max. cruise) 5 gr. (.011 lb.) per h.p./hr. max.

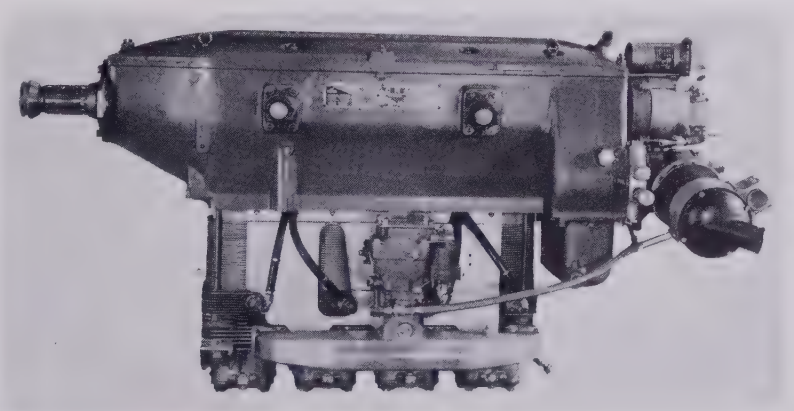
THE SNECMA 14X HELICOPTÈRE.

This engine is an adaptation of the standard 14X for helicopter installation. It differs from the standard engine in that it can operate with the axis of the engine at either 45° or 90° ; the reduction gear has been replaced by a cooling fan and a centrifugal clutch ; the rotational speeds at maximum and cruising powers are practically the same ; and the blower ratio is 7.30 : 1.

PERFORMANCE*.—
Max. power for 1 hour 790 h.p. at 2,700 r.p.m. from 0 to 1,400 m. (4,590 ft.).
Max. continuous power 635 h.p. at 2,700 r.p.m. from 0 to 2,900 m. (9,510 ft.).
Cruising power 475 h.p. at 2,700 r.p.m. from 0 to 4,800 m. (15,745 ft.).
*The powers indicated are effective for driving the rotor mechanism. The engine cooling is assured.
FUEL CONSUMPTION (Grade 100/130).—
At max. power (for 1 hour) 330 gr. (.72 lb.) per h.p./hr.
At max. continuous power 300 gr. (.66 lb.) per h.p./hr.
At cruise power 220 gr. (.48 lb.) per h.p./hr.
OIL CONSUMPTION.
At cruise power 5 gr. (.011 lb.) per h.p./hr.

THE SNECMA RÉGNIER 4L.00.

TYPE.—Four-cylinder in-line inverted air-cooled.
CYLINDERS.—Bore 120 mm. (4.72 in.). Stroke 140 mm. (5.51 in.). Capacity 6.3 litres (384.4 cub. in.). Compression ratio 6.2 : 1. Steel barrels machined all over and treated externally with a baked-on varnish to prevent corrosion. Separate Y-alloy heads held on barrels by four long bolts screwed into crankcase with a Metalloplastic joint between head and barrel and a dermatine sealing ring between barrel and crankcase. Valve seats and sparking-plug bushes of bronze-aluminium screwed into head. Rocker boxes integral with heads have Elektron covers held in place by quick-release cables.
VALVE GEAR.—One inlet and one exhaust underhead valve per cylinder, each with two springs. Valves operated from camshaft through push rods and adjustable tappets. Engine valve-gear enclosed.
CRANKSHAFT.—Four-throw steel forging on five bearings.
CONNECTING RODS. — I-section duralumin forgings with split steel-backed bronze bearings.
CRANKCASE.—Magnesium casting carrying the main crankshaft bearings which are held in position by separate caps. All oilways cast internally. All accessory drives and oil pumps enclosed in rear portion of case. Magnesium cover provided with breather and lifting rings.
IGNITION.—B.G. type 4D4 dual magneto with automatic advance. Two B.G. 4CT2 or Eyquem 612P plugs per cylinder. Shielded ignition harness optional.
CARBURATION.—Zenith type IDCA carburettor on port side of engine. Welded sheet steel manifold with heater muff. Two Guyot type K or O fuel pumps.
LUBRICATION.—Pressure lubrication. Engine-driven gear type pump. All oilways in crankcase casting or drilled in crankshaft webs. Two scavenge pumps, one forward and one aft. Provision for scavenging from crankcase cover when engine inverted.
DIMENSIONS.—
Length (over starter) 1,366 mm. (53.7 in.).
Height 760 mm. (29.8 in.).
Width 500 mm. (19.6 in.).
WEIGHT DRY.—
155 kg. (341 lb.).
PERFORMANCE.—
Take-off output 147 h.p. at 2,340 r.p.m.
Max. continuous output 135 h.p. at 2,280 r.p.m.
Max. cruising output 116 h.p. at 2,160 r.p.m.
Recommended cruising output 106 h.p. at 2,100 r.p.m.
FUEL CONSUMPTIONS. –
Max. continuous 46 litres (10.1 Imp. gallons) per hour.
Max. cruising 35 litres (7.7 Imp. gallons) per hour.
Recommended cruising 32 litres (7 Imp. gallons) per hour.



The 135 h.p. SNECMA Régnier 4L.04 four-cylinder inverted engine.

THE SNECMA RÉGNIER 4L.02.

The 4L.02 is similar to the 4L.00 except for the following differences.

COMPRESSION RATIO.—7.25.

PERFORMANCE.—
- Take-off output 170 h.p. at 2,500 r.p.m.
- Max. continuous output 170 h.p. at 2,500 r.p.m.
- Max. cruising output 119 h.p. at 2,220 r.p.m.
- Recommended cruising output 110 h.p. at 2,160 r.p.m.

FUEL CONSUMPTIONS.
- Take-off 53 litres (11.6 Imp. gallons) per hour.
- Max. cruising 34 litres (7.5 Imp. gallons) per hour.
- Recommended cruising 31 litres (6.82 Imp. gallons) per hour.

THE SNECMA REGNIER 4L.04.

The 4L.04 differs from the 4L.00 in certain re-arrangement of accessories. It is in production for installation in the N.C. 856A military observation aircraft which is being built in series for the French Army.

THE SNECMA RENAULT 12S.02.

TYPE.—Twelve-cylinder inverted 60° Vee air-cooled, geared and supercharged.

CYLINDERS.—Bore 105 mm. (4.134 in.). Stroke 115 mm. (4,528 in.). Capacity 12 litres (732.3 cub. in.). Compression ratio 6.4 :1. Steel barrels, heat-treated aluminium-alloy heads. Exhaust valve seats of steel, inlet seating, valve guides and spark-plug adaptors of bronze.

PISTONS. — Aluminium - alloy. Three compression and one scraper rings.

CONNECTING RODS. — H-section forgings machined all over. Lead-bronze bearings in steel shells.

CRANKSHAFT. — Six - throw steel forging machined all over. Seven main bearings of lead-bronze in steel shells.

CRANKCASE.—Electron barrel type casting with top cover, closed forward by reduction gear casing and aft by blower casing and rear cover.

VALVE GEAR.—One inlet and one exhaust valve per cylinder. Entire gear enclosed.

INDUCTION.—Bronzavia type 9 2195 AI carburettor with automatic boost and altitude control and air-warming. Bronzavia type. Bronzavia type 30.900 double fuel pump with by-pass, Bronzavia type 11.900 pressure regulator.

SUPERCHARGER.—Single-speed, single-stage centrifugal blower. Ratio 9.35 : 1.

IGNITION.—A.B.G. type 12D 12 dual magneto with automatic advance mechanically and hydraulically coupled to throttle. Two B.G. type RB590FR or K.L.G. type RFC 54/R plugs per cylinder. Screened ignition harness.

CONTROLS.—A single throttle control links the induction, ignition and airscrew controls, there being only three positions (55°, 75° and 90°) of the throttle other than idling.

LUBRICATION.—Dry sump system. One high and one low pressure and two scavenge pumps.

STARTER.—Air Equipement type 50920 hand/electric direct starter.

AIRSCREW DRIVE.—Epicyclic reduction gear. Ratio 1 : 1.75.

DIMENSIONS.—
- Length 1,366 mm. (53.7 in.).
- Height 755 mm. (29.7 in.).
- Width 500 mm. (19.6 in.).

WEIGHT.—
- 369 kg. (812 lb.).

PERFORMANCE.—
- Take-off output 600 h.p. at 3,300 r.p.m.
- Max. continuous output 439 h.p. at 3,250 r.p.m. at 2,400 m. (7.870 ft.).
- Max. cruising output 350 h.p. at 3,100 r.p.m. at 2,600 m. (8,530 ft.).
- Recommended cruising output 300 h.p. at 2,900 r.p.m. at 2,800 m. (9,185 ft.).

FUEL CONSUMPTIONS.—
- Max. continuous 188 litres (41.3 Imp. gallons) per hour.
- Max. cruising 102 litres (22.4 Imp. gallons) per hour.
- Recommended cruising 84 litres (18.4 Imp. gallons) per hour.

SALMSON

SOCIÉTÉ DES MOTEURS SALMSON.

HEAD OFFICE : 102*bis*, RUE DU POINT-DU-JOUR, BILLANCOURT (SEINE).

This very old-established firm which produced its first engines a year or two before the 1914-18 war and developed and marketed a range of low and medium-powered radial engines suitable for touring and training aircraft between the wars, went into liquidation in 1951.

After the last war several of the company's radial engines were revised and put into production, together with the Argus As 10c inverted vee eight-cylinder engine which was built to German account during the war.

Since the liquidation the Salmson 8 AS 04 derived from the Argus As 10C, has completed 500 hours of test running, and development orders have been received by the company for the 8 AS 06, an improvement of the 04 engine, and for the 9 NH helicopter engine.

The 240 h.p. Salmson 8 AS and the 9 ADB, 5AQ-01 and 9 NH radials have been described in previous editions of "All the World's Aircraft."

ITALY

ALFA

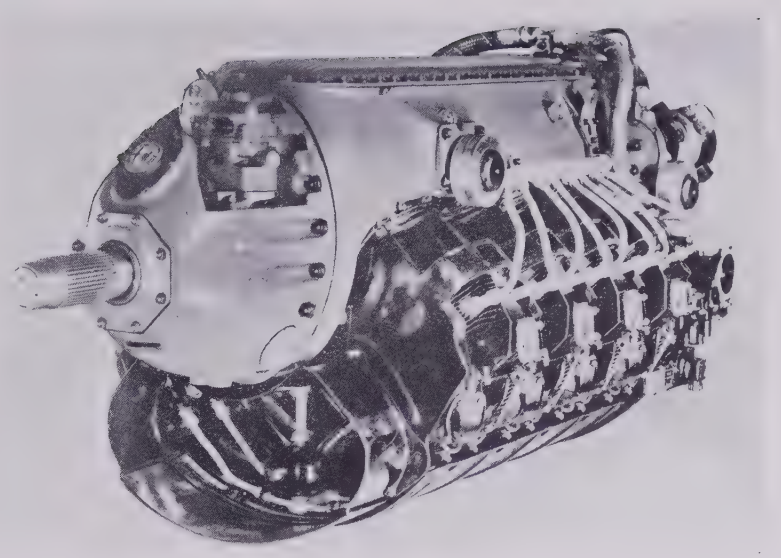
SOCIETÀ per AZIONI ALFA ROMEO.

HEAD OFFICE AND WORKS: VIA M.U. TRAIANO 33, MILAN.

This important company, manufacturers of the well-known Alfa-Romeo automobile, entered the Italian aero-engine industry in 1925 with the acquisition of the Jupiter engine licence from the Bristol Aeroplane Co., Ltd., and the Lynx engine licence from Armstrong Siddeley Motors, Ltd. In 1930 the company produced its first engine of original design, the D2, and in the following year it acquired licences to build the Bristol Mercury and Pegasus engines.

With the experience gained in the development and production of the above-mentioned engines the Alfa company embarked in an extensive programme of original engine design and production.

Current types of Alfa engines are 157 h.p. type 100*ter* P, the 225 h.p. type 115*ter* and the 400 h.p.type 121.



The 400 h.p. Alfa 121 eight-cylinder inverted Vee engine.

THE ALFA 121.

TYPE.—Eight-cylinder 90° inverted vee air-cooled, geared and supercharged.

CYLINDERS.—Bore 120 mm. (4.72 in.). Stroke 110 mm. (4.33 in.). Capacity 9.952 litres. Compression ratio 6.5 : 1. Nitrided steel barrels machined all over. Aluminium-alloy cylinder heads.

PISTONS.—Duralumin forgings. Three compression rings and one scraper ring above gudgeon-pin, one scraper ring below.

CONNECTING RODS.—Forked rods are steel stampings machined all over. Anti-friction bearings.

CRANKSHAFT.—Four-throw 90° single-piece shaft running on five indium-plated bearings.

CRANKCASE.—Double-wall single-piece Elektron casting.

REDUCTION GEAR.—Spur gear type. Ratio 0.621 : 1.

SUPERCHARGER.—Centrifugal type. Gear ratio 7 : 1.

CARBURATION.—Two Mona Type AO 58 horizontal carburettors mounted on rear of supercharger casing, or Hobson type DHG5 injection carburettor.

FUEL GRADE.—100/130.

IGNITION.—Twin Marelli or RB C 4/8 magnetos. Shielded ignition harness.

LUBRICATION.—Pressure type. One pressure and three scavenge pumps, one of which for inverted flight. High initial oil pressure device.

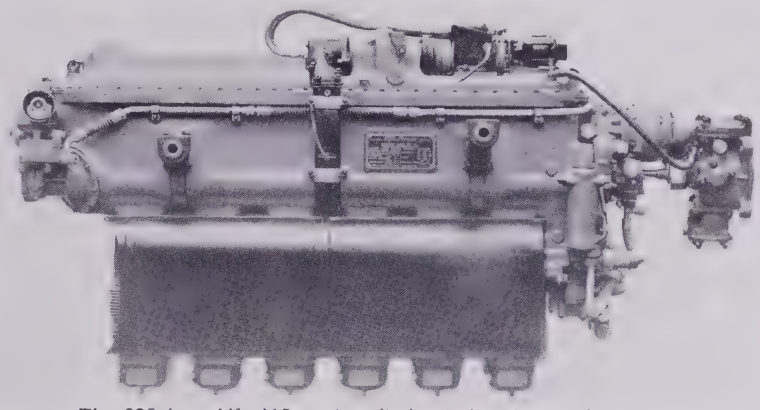
DIMENSIONS.—
Overall width 0.684 m. (26.9 in.).
Overall height 0.700 m. (27.5 in.).
Overall length (including all accessories) 1,780 m. (70 in.).

WEIGHT DRY.—
345 kg. (760 lb.).

PERFORMANCE.—
Take-off output 400 h.p. at 3,000 r.p.m.
Max. continuous output at sea level 330 h.p. at 3,000 r.p.m.
Max. continuous output at 2,000 m. (6,560 ft.) 355 h.p. at 3,000 r.p.m.
Cruising output 250 h.p. at 2,700 r.p.m.

FUEL CONSUMPTIONS.—
At take-off power 290 gr./h.p./hr. (0.63 lb./h.p./hr.).
At max. continuous power 267 gr./h.p./hr. (0.58 lb./h.p./hr.).
At max. continuous power at 2,000 m. (6,600 ft.) 250 gr./h.p./hr. (0.55 lb./h.p./hr.).
At cruising power 2,700 r.p.m., 248 gr./h.p./hr. (0.54 lb./h.p./hr.).

OIL CONSUMPTION.—
Max. 2.5 kg./hr. (5.5 lb./hr.).



The 225 h.p. Alfa 115*ter* six-cylinder in-line inverted engine.

THE ALFA 115*ter*.

TYPE.—Six-cylinder in-line inverted air-cooled. This engine is designed for inverted flying and is equipped with a hydraulic airscrew control.

CYLINDERS.—Bore 118 mm. (4.65 in.) Stroke 140 mm. (5.52 in.). Total swept volume 9.186 litres (560 cub.in.). Compression ratio 6.5/1. All over machined nitrided steel cylinder barrel. Aluminium-alloy cylinder head castings.

PISTONS.—Duralumin forging. Two compression rings and two scraper rings, one above and one below the gudgeon pin.

CONNECTING RODS.—Duralumin forging machined all over.

CRANKSHAFT.—Six-throw single-piece steel forging running in eight bearings.

CRANKCASE.—Elektron casting.

VALVE GEAR.—Two valves per cylinder. Nitrided valve stems. Sodium cooled exhaust valves.

CARBURATION.—Two Mona type A1.55 /E3 downdraught carburettors with automatic mixture controls.

FUEL GRADE. 100 130.

IGNITION.—Two screened Marelli type ST 345 DAS or Rotax NGA magnetos. Two sparking-plugs per cylinder. Screened ignition harness.

LUBRICATION.—Pressure type. One pressure and three scavenge pumps, one for inverted flight.

ACCESSORY DRIVES.—By engine remote driven gearbox through articulated joints.

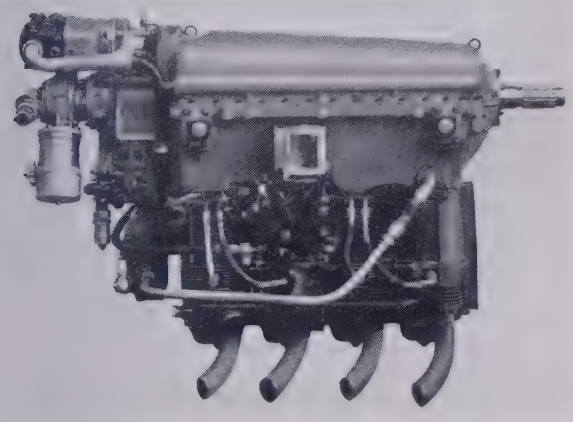
WEIGHT DRY.—233 kg. (515 lb.).

DIMENSIONS.—
Overall length 1,642 mm. (64.7 in.).
Overall width 498 mm. (19.6 in.).
Overall height 825 mm. (32.5 in.).

PERFORMANCE.—
Max. output at ground level 225 h.p. at 2,400 r.p.m.
Normal output 215 h.p. at 2,250 r.p.m.

FUEL CONSUMPTIONS.—
At take-off power 242 gr./h.p./hr. (0.53 lb./h.p./hr.).
At max. continuous power 250 gr./h.p./hr. (0.55 lb./h.p./hr.).

OIL CONSUMPTION.—
Max. 2.5 kg./hr. (5.5 lb./hr.).



The 157 h.p. Alfa 110*ter* P. four-cylinder inverted engine.

THE ALFA 110*ter* P.

TYPE.—Four-cylinder in-line inverted air-cooled.

CYLINDERS.—Bore 118 mm. (4.65 in.). Stroke 140 mm. (5.52 in.). Total swept volume 6,124 litres. Compression ratio 6.5 : 1. Nitrided steel cylinder barrels. Aluminium-alloy cylinder heads.

PISTONS.—Duralumin forgings. Two compression rings and two scraper rings, one above and one below the gudgeon pin.

CONNECTING RODS.—Duralumin forgings machined all over.

CRANKSHAFT.—Four-throw single-piece shaft running on five indium-plated bearing.

CRANKCASE.—Single-piece aluminium casting with Elektron cover.
VALVE GEAR.—Two valves per cylinder. tappet-operated. Sodium-cooled exhaust valves.
CARBURATION.—One Mona AI. 55 E/3 downdraught carburettor with automatic mixture control.
IGNITION.—One twin Bosch ZJ 4 CR 5 magneto. Two spark-plugs per cylinder. Screened ignition system.
LUBRICATION.—Pressure type. One pressure and one scavenge pump. High initial oil pressure device.
STARTING.—Marelli AI 38C electric and hand starter.
DIMENSIONS.—
Overall length 1,232 mm. (4.85 in.).
Overall width 584.5 mm. (23.0 in.).
Overall height 775.5 mm. (30.6 in.).
WEIGHT DRY.—
163 kg. (360 lb.).
PERFORMANCE.
Take-off output 157 h.p. at 2,400 r.p.m.
Max. continuous output at sea level 150 h.p. at 2,250 r.p.m.
FUEL CONSUMPTION.—
At take-off power 251 gr./h.p./hr. (0.55 lb./h.p./hr.).
At max. continuous 257 gr./h.p./hr. (0.57 lb./h.p./hr.).
OIL CONSUMPTION.—
0.4-0.6 kg./hr. (0.9-1.3 lb./hr.).

ISOTTA-FRASCHINI

FABBRICA AUTOMOBILI ISOTTA-FRASCHINI.

HEAD OFFICE: 89, VIA MONTEROSA, MILAN.

President and Director-General: Ing. Brocchieri Beonio.

The Isotta-Fraschini Company was incorporated in 1898 in Milan for the manufacture of automobiles and internal combustion engines, and since the earliest days of flying was engaged in the design and manufacture of aero-engines.

Before the War 1914-18 a number of Isotta-Fraschini engines were used in Italian airships, aeroplanes and seaplanes. During that War, nearly 5,000 Isotta-Fraschini engines were made and nearly all the aero-engines produced in Italy were made under Isotta-Fraschini licence.

The later engines of Isotta-Fraschini design included the 700 h.p. Delta R.C. 351 and 500 h.p. Gamma R.C.151, both twelve-cylinder inverted vee air-cooled units; the 450 h.p. Astro 7.C.40 and 890 h.p. Astro 14.C.40, both air-cooled radials; the 900 h.p. Asso L.121.R.C.40 twelve-cylinder upright vee liquid-cooled; and the 1,500 h.p. Asso L.180 R.C.I.45 eighteen-cylinder inverted W liquid-cooled engine. All these engines have been described in previous issues of this Annual.

Since the war the company has been engaged mainly in overhaul and repair work.

THE SOVIET UNION

(The Union of Soviet Socialist Republics)

Russian piston engines, with the exception of a few types of low-powered radial engines, have been mainly developments of foreign designs. The VK Series was based on the French Hispano Suiza 12Y liquid-cooled twelve-cylinder vee; the M.25, 62 and 63 Series were derived from the American Wright R-1820 Cyclone; the M.88 and 89 from the French Gnôme-Rhône 14R; the AM.38 and 42 were based on the German BMW VI twelve-cylinder liquid cooled engine; the ASh. 82 was a development of the American Pratt & Whitney R-1830 Twin-Wasp; the ASh.90 is a copy of the Wright R-3350 engine which was produced to power the Russian copies of the B-29. Most of these engines have been subject to development, but no information, other than that which has appeared in recent issues of "All the World's Aircraft" has become available.

Aero-engine research and development is undertaken by the Ts.A.I.M. (founded in 1930) and all production is handled by State factories. The various engine models are the products of design teams led by responsible engineers. For example, the design of the VK Series is attributed to V. Y. Klimov; the AM Series to Aleksandir Mikulin; and the ASh and M Series to A. D. Shvetsov. For details of the various piston engines already mentioned reference should be made to previous editions of "All the World's Aircraft." Brief details of Russian jet engine development will be found in the Gas Turbine Section of this edition.

SPAIN

E.N.M.A.

EMPRESA NACIONAL DE MOTORES DE AVIACIÓN S.A.

HEAD OFFICE: CALLE DE VALENCIA, 302, BARCELONA.

WORKS: PASEO DEL GENERAL MOLA, 39, BARCELONA, AND CARRETERA DE SAN ADRIAN S/N, SAN ANDRES, BARCELONA.

President: Ilmo. Sr. D. Modesto Aguilera Morente.

Managing Director: D. Antonio Guerendiain Ponte.

The Empresa Nacional de Motores de Aviación, which took over the Elizalde organization on January 1, 1952, continues to manufacture the Tigre G-IV four-cylinder inverted air-cooled engine, of which there are two models A and B with outputs of 125 and 150 h.p. respectively, and the 500 h.p. Sirio VII-2 seven-cylinder radial.

Under development are the 275 h.p. Alcion seven-cylinder radial, the 90 h.p. Flecha flat-four and the Tigre G-5. The Tigre G-5 is similar to the G-IV-B engine but will be specially equipped for inverted flying and aerobatics.

The E.N.M.A. Tigre in both its 125 and 150 h.p. versions powers the C.A.S.A. built Bücker 131 and various H.M. light aircraft built by AISA. The E.N.M.A. Sirio radial powers the C.A.S.A. 201 and 202 twin-engined commercial monoplanes, and the Hispano HS-42 single-engined trainer.

THE E.N.M.A. SIRIO S-VII-2.

TYPE.—Seven-cylinder radial air-cooled, supercharged.

CYLINDERS.—Bore 150 mm. (5.9 in.). Stroke 145 mm. (5.75 in.). Capacity 17.93 litres (1,090 cub. in.). Compression ratio 6 : 1. Finned steel barrels with cast aluminium head screwed on. One inlet and one sodium-cooled exhaust valve per cylinder.

PISTONS.—Aluminium alloy. Floating gudgeon-pins. Three compression rings and two scraper rings.

CONNECTING RODS.—Master rod and six auxiliary connecting-rods carried on wrist pins. Special bronze little-end bearings.

CRANKSHAFT.—Single-throw shaft in two halves clamped and keyed together. On two roller bearings and one ball bearing for the tail shaft.

CRANKCASE.—Barrel-type single-piece main case of cast Elektron, and a rear case and corresponding cover, which houses the compressor and all accessories.

VALVE GEAR.—Fully-enclosed valve gear comprising push-rods, rocker-arms, etc. with pressure lubrication and scavenge return.

LUBRICATION.—Four pumps in the lower part of the rear crankcase, one pressure and three scavenge pumps. A filter at the outlet of the pressure pump is easily accessible for cleaning. Oil pressure 4 kg./cm.² (56.8 lb./sq. in.).

IGNITION.—Two Scintilla type 2L V7-D4-FE.90 automatic-advance magnetos. Two plugs per cylinder.

CARBURATION.—One double down-draught 1RZ Type A-72-D.E carburettor with heater, warm air intake and automatic boost control.

SUPERCHARGER.—Centrifugal type with a gear ratio of 7.85 : 1.

ACCESSORIES.—Fuel pump, compressed air starter and couplings for electric generator, inertia starter, vacuum pump, tachometer and temperature and pressure gauges for fuel, oil, etc.

FUEL GRADE.—87 Octane.

DIMENSIONS.—
Overall diameter 1,120 mm. (44.1 in.).
Length 1,127 mm. (44.4 in.).

WEIGHT.—
327 kg. (719.4 lb.).

PERFORMANCE.—
Max. output 500 h.p. at 2,300 r.p.m.
Normal output 440 h.p. at 2,100 r.p.m. at 2,000 m. (6,560 ft.).
Cruising output (87% power) 382 h.p. at 2,000 r.p.m. at 2,500 m. (8,200 ft.).
Cruising output (75% power) 330 h.p. at 1,850 r.p.m. at 2,500 m. (8,200 ft.).

CONSUMPTIONS.—
Normal output: fuel 280 gr. (.617 lb.) per h.p./hr., oil 12 gr. (.0154 lb.) per h.p./hr.
Cruising: fuel 250 gr. (.551 lb.) per h.p./hr., oil 8 gr. (.0176 lb.) per h.p./hr.

THE E.N.M.A. BETA B-4.

TYPE.—Nine-cylinder radial air-cooled, supercharged.

CYLINDERS.—Bore 155.5 mm. (6.1 in.). Stroke 174.6 mm. (6.8 in.). Capacity 29.85 litres (1,820 cub. in.). Compression ratio 6.4 : 1. Finned steel barrels with cast aluminium-alloy head screwed on. One inlet and one sodium-cooled exhaust valve per cylinder.

CRANKSHAFT.—Single-throw shaft in two pieces clamped and keyed together. Shaft runs on two roller bearings and one ball thrust bearing.

CRANKCASE.—Barrel type of aluminium-alloy.

VALVE GEAR.—Fully-enclosed, with pressure lubrication and scavenge return.

LUBRICATION.—One pressure and one scavenge pump. Oil pressure 3.5-5.5 kg./cm.² (49-77 lb./sq. in.).

IGNITION.—Two FEMSA MAQ-9 magnetos. Two 18 mm. spark-plugs per cylinder.

CARBURATION.—One 1RZ four-barrel down-draught carburettor.

SUPERCHARGER. Centrifugal type. Gear ratio 8.31 : 1.

FUEL GRADE.—87 Octane minimum.

STARTING.—Provision for electric starter or FEMSA hand inertia starter.

DIMENSIONS.—
Diameter 1.365 m. (53.7 in.).
Length 1.170 m. (46 in.).

WEIGHT.—
468 kg. (1,030 lb.).

PERFORMANCE.—
Take-off output 775 h.p. at 2,200 r.p.m.
Normal output 750 h.p. at 2,100 r.p.m. at 2,900 m. (9,510 ft.).
Cruising output 550 h.p. at 1,600 r.p.m. at 3,000 m. (9,840 ft.).

CONSUMPTIONS.—
Fuel (cruising) 250 gr./h.p./hr. (.55 lb./h.p./hr.).
Oil (cruising) 8 gr./h.p./hr. (.0176 lb./h.p./hr.).

THE E.N.M.A. ALCION A-1.

The E.N.M.A. Alcion, which is being built in prototype form, is a seven-cylinder geared and supercharged air-cooled radial. The following are its principal particulars :—

TYPE.—Seven-cylinder radial air-cooled. geared and supercharged.

CYLINDERS.—Bore 110 mm. (4.33 in.). Stroke 110 mm. (4.33 in.). Capacity 7.317 litres (446 cub. in.). Compression ratio 6.5 : 1.

LUBRICATION.—Pressure type. Four pumps. Oil pressure 4 kg./cm.² (56.8 lb./sq. in.).

CARBURATION.—Updraught carburettor.

FUEL GRADE.—100 Octane.

SUPERCHARGER.—Centrifugal. Gear ratio 7.979 : 1.

IGNITION.—Two FEMSA magnetos with automatic advance. Two 18 mm. spark-plugs per cylinder.

AIRSCREW REDUCTION GEAR.—Planetary. Gear ratio 0.66 : 1.

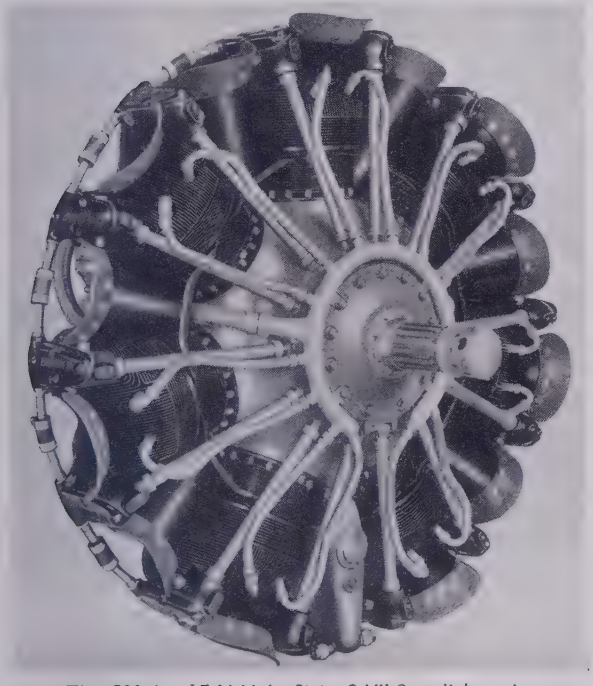
STARTING.—FEMSA electric starter.

DIMENSIONS.—
Diameter 0.850 m. (33.46 in.).
Length 1.166 m. (45.90 in.).

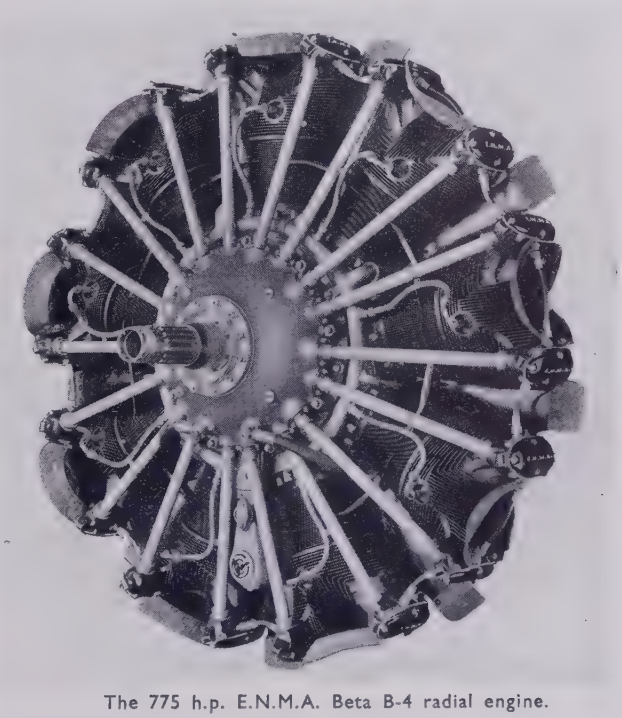
WEIGHT.—
225 kg. (495 lb.).

PERFORMANCE.—
Take-off output 275 h.p. at 3,000 r.p.m.
Normal output 250 h.p. at 2,800 r.p.m. at 1,500 m. (4,920 ft.).
Cruising output 175 h.p. at 2,400 r.p.m. at 2,000 m. (6,560 ft.).

CONSUMPTIONS.—
Fuel (cruising) 210 gr./h.p./hr. (.46 lb./h.p./hr.).
Oil (cruising) 8 gr./h.p./hr. (.0176 lb./h.p./hr.).



The 500 h.p. E.N.M.A. Sirio S-VII-2 radial engine.



The 775 h.p. E.N.M.A. Beta B-4 radial engine.

THE E.N.M.A. FLECHA F-IV-1.

The Flecha is an air-cooled flat-four engine which is being built in prototype form. The following are its principal particulars.

TYPE.—Four-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore 105 mm. (4.1 in.). Stroke 100 mm. (3.9 in.). Capacity 3.46 litres (211 cub. in.). Compression ratio 7 : 1. Steel cylinders with light alloy heads.

VALVE GEAR.—One inlet and one exhaust valve per cylinder.

CRANKSHAFT.—One-piece steel forging with four throws and running on three bearings.

CRANKCASE.—Aluminium alloy case in two parts, split in vertical plane.

CARBURATION.—"IRZ," Stromberg NA-SE A1 or similar carburettor. S-6000 SS fuel pump.

FUEL GRADE.—87 Octane minimum.

IGNITION.—Two FEMSA magnetos. Two Champion C 27 S or similar spark-plugs per cylinder. Order of firing 1-3-2-4.

LUBRICATION.—Pressure type. Maximum pressure 4 kg./cm.² (56.8 lb./sq. in.) minimum pressure 1.5 kg./cm.² (21.3 lb./sq. in.).

STARTING.—FEMSA electric starter.

ACCESSORIES.—FEMSA 300-watt 24-volt generator.

DIMENSIONS.—
Width 804 mm. (31.64 in.).
Length 809 mm. (31.84 in.).
Height 728 mm. (27.96 in.).

WEIGHT.—
85-90 kg. (187-198 lb.).

PERFORMANCE.—
Nominal output 90 h.p. at 2,500 r.p.m.

CONSUMPTIONS.—
Fuel (max.) 250 gr./h.p./hr. (.551 lb./h.p./hr.).
Oil (cruising) 9 gr./h.p./h.r. (.0198 lb./h.p./hr.).

THE E.N.M.A. TIGRE G-IV-A AND G-IV-B.

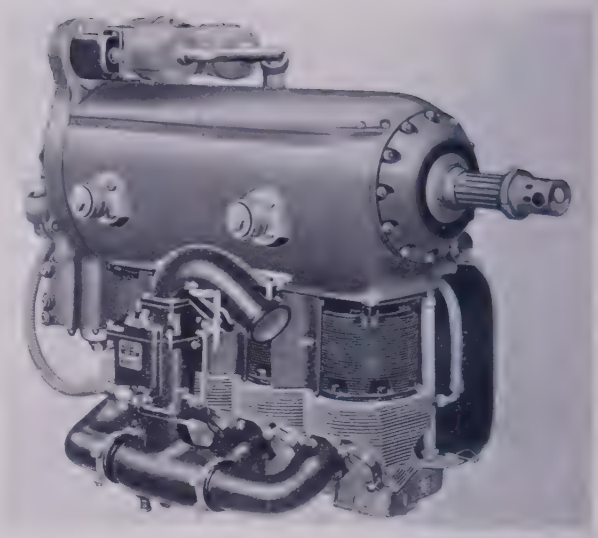
TYPE.—Four-cylinder in-line inverted air-cooled.

CYLINDERS.—Bore 120 mm. (4.72 in.). Stroke 140 mm. (5.512 in.). Capacity 6.3 litres (386.3 cub. in.). Compression ratio 6 (IVA) or 6.5 (IVB) : 1. Cast Y-alloy cylinder heads. Forged and machined chrome-molybdenum steel barrels. Heads attached to barrels by six studs. Aluminium-bronze inlet valve seats. Austenitic steel exhaust valve seats.

PISTONS.—Aluminium-alloy. Fully-floating gudgeon-pins.

CONNECTING RODS.—Forged aluminium-alloy. Copper-lead big-end bearings, special bronze small-end bearings.

CRANKSHAFT.—Forged and machined chrome-nickel steel four-throw shaft on four copper-lead main bearings and one ball thrust bearing.



The 150 h.p. E.N.M.A. Tigre G-5 four-cylinder engine, which is specially equipped for inverted flying and acrobatics.

CRANKCASE.—Main case of Electron. Aluminium-alloy top cover.

CARBURATION.—IRZ type A-56 IE (G-IV A) or A-56-IE.B (G-IV B) inverted carburettor.

IGNITION.—Two Femsa magnetos, type MVE.4-109A/B.

LUBRICATION.—Pressure by triple pump driven from rear end of camshaft. Triple oil filter. Oil pressure 2-4 kg./cm.² (28.4-56.8 lb./sq. in.).

FUEL GRADE.—80 Octane.

STARTING.—E.N.M.A. G.3001 GG hand inertia starter. Provision for alternative fitting of electric starter.

DIMENSIONS.—
Length 1,128 mm. (44.33 in.).
Width 400 mm. (15.76 in.).
Height 757 mm. (2.982 in.).

WEIGHT (G-IV A).—
135 kg. (297 lb.).

WEIGHT (G-IV B).—
147 kg. (323 lb.).

PERFORMANCE (G-IV A).—
Normal output 125 h.p. at 2,000 r.p.m.
Cruising output 100 h.p. at 1,850 r.p.m.

PERFORMANCE (G-IV B).—
Normal output 150 h.p. at 2,300 r.p.m.
Cruising output 120 h.p. at 2,140 r.p.m.

CONSUMPTIONS.—
At cruising output (7/10 power).
Fuel 225 gr. (.496 lb.) per h.p./hr.
Oil 8 gr. (.0176 lb.) per h.p./hr.

UNITED STATES OF AMERICA

CONTINENTAL

THE CONTINENTAL MOTORS CORPORATION, AIRCRAFT ENGINE DIVISION.

HEAD OFFICE: MUSKEGON, MICH.

WORKS: MUSKEGON AND DETROIT, MICH.

President and General Manager: C. J. Reese.

Vice-President in charge of Sales and Service, Aircraft Division: D. H. Hollowell.

Chief Engineer, Aircraft Division: W. A. Wiseman.

Treasurer: H. W. Vandeven.

In 1928, Continental Motors Corporation, one of the largest automobile engine manufacturers in the World, produced a sleeve-valve radial air-cooled aero-engine incorporating the Argyll (Burt-McCollum) patents, which had been purchased by the Corporation from the British Argyll Company in 1925.

In 1931 the 38 h.p. A40 flat-four was put on the market. This was followed by the A50, A65, A75 and A80 engines, the popularity of which resulted in over 8,000 Continental flat-four engines being produced up to the outbreak of war.

The current range of Continental light aircraft engines include the A65-8, C85-12, C90-12F, C145-2, E185, E225-4, O-315-A, O-470-A, O-470-B and SO-470.

THE CONTINENTAL A65 SERIES.

TYPE.—Four-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore $3\frac{7}{8}$ in. (98.43 mm.). Stroke $3\frac{5}{8}$ in. (92 mm.). Capacity 171 cub. in. (2.8 litres). Compression ratio 6.3 : 1. Heat-treated cast aluminium-alloy heads screwed and shrunk on to forged-steel barrels. Valve-seat inserts and spark-plug bushings of aluminium-bronze. Bronze valve-guides.

PISTONS.—Lo-Ex duralumin-alloy. Trunk type. Full floating gudgeon pin located by end-plugs. Two compression and one scraper rings above gudgeon pins.

CONNECTING RODS.—Forged steel. Split big-ends carry replaceable thin-shell steel-backed Tri-metal bronze bearings. Bronze bushings pressed into gudgeon pin ends.

CRANKSHAFT.—One-piece, four-throw, chromium-nickel-molybdenum steel forging, drilled for lubrication, runs in three steel-backed Tri-metal bronze bearings, one of which is at middle of shaft.

CRANKCASE.—Two-piece heat-treated aluminium casting divided at vertical lengthwise plane through crankshaft. Rigid transverse webs carry main bearings and camshaft journals. Rawhide seal prevents oil leakage at airscrew. Four engine-mounting bosses for $\frac{3}{8}$-in. (9.5 mm.) bolts at rear of crankcase.

VALVE GEAR.—One hardened steel inlet-valve and one heat-resisting austenitic exhaust-valve per cylinder, each operated through rocker-arm, ball-ended push-rod and Wilcox-Rich hydraulic tappet, all sealed to prevent external oil leakage. Cast Preferall camshaft has six hardened cams (intake cams are common to opposing cylinders). Three hardened journals and overhung eccentric at airscrew end to run fuel pump.

INDUCTION SYSTEM.—Single up-draught Stromberg NA-S3A1 carburettor supplies mixture to cast-aluminium X-manifold with exhaust-heated hot-spot. Steel intake pipes connect manifold to intake ports.

IGNITION.—Dual magnetos either Eisemann LA-4, Case 4-CAM-E or Scintilla S4-RN-20.

LUBRICATION.—Oil at 30 lb./sq. in. (2.11 kg./cm.^{2}) passes through oil tubes in crankshaft to crank-pins and also passes through tappet, push-rod and rocker-arm to rocker-arm bushing and valve-tip. Valve-stem and guide lubricated by splash. Oil returned to crankcase by way of push-rod housings. Pressure filter and relief-valve in crankcase.

AIRSCREW DRIVE.—R.H. tractor. Direct. No. 0 S.A.E. taper.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE CONTINENTAL C85 SERIES.

The C85 Series is identical to the C75 Series except that the C85 carburettor has a $1\frac{3}{8}$in. (29 mm.) venturi as compared with $1\frac{5}{16}$ in. (33.2 mm.) for the C75 and larger main metering jet. The normal rated r.p.m. of the C85 is increased from 2,275 to 2,575 and the cruising r.p.m. from 2,125 to 2,400. The rated output is consequently increased from 75 to 85 h.p.

The Series 8 engine has a tapered crankshaft while the sub-type 8F has a flanged shaft. The Series 12 has the addition of starter and generator drives in the accessory case.

General constructional details are similar to those of the A65 Series. For other details see Table.

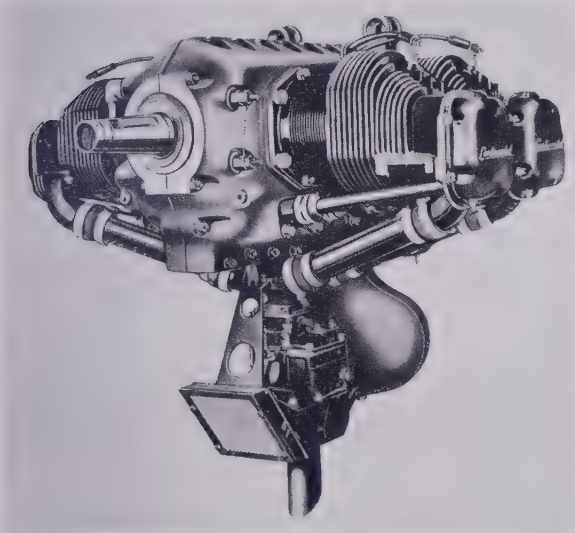
THE CONTINENTAL C90 SERIES.

The C90 Series includes the C90-8F which has a flanged crankshaft but does not have provisions for installing either a starter or generator, and the C90-12F which has a flanged crankshaft and Delco-Remy starter and generator.

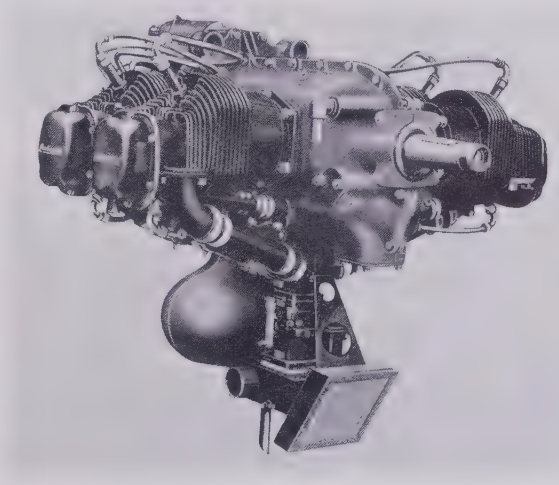
This Series differs from the C85 Series in having cylinders with a slightly larger bore. Otherwise the two engines are constructionally the same. The C90 Series engines have an approved take-off rating of 95 h.p. at 2,625 r.p.m. For other details see Table.

THE CONTINENTAL C145.

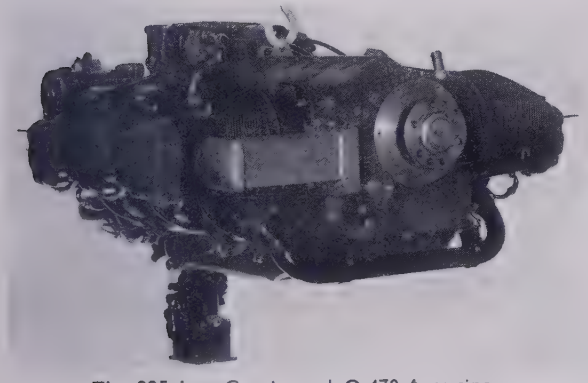
This engine is similar to the C125 except that the cylinder bore is increased by $\frac{1}{4}$ inch, with a resultant increase in capacity and output. Other details will be found in the Table.



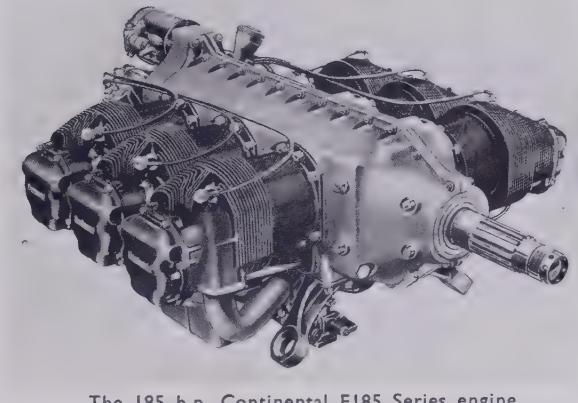
The 65 h.p. Continental A65 Series engine.



The 85 h.p. Continental C85 Series engine.



The 225 h.p. Continental O-470-A engine.



The 185 h.p. Continental E185 Series engine.

THE CONTINENTAL HORIZONTALLY-OPPOSED ENGINES.

Engine Model	No. of Cylinders	Bore and Stroke	Capacity	Rated Output	Compression Ratio	Dry Weight	Length	Width	Fuel
A65-8	4	3⅞ in. × 3⅝ in. (98.4 mm. × 92 mm.)	171 cub. in. (2.04 litres)	65 h.p. at 2,300 r.p.m.	6.3 : 1	176 lb. (79.9 kg.)	31 in. (787 mm.)	31.5 in. (800 mm.)	73
C85-8	4	4 1/16 in. × 3⅝ in. (103.2 mm. × 92 mm.)	188 cub. in. (3.08 litres)	85 h.p. at 2,575 r.p.m.	6.3 : 1	176 lb. (79.9 kg.)	31 in. (787 mm.)	31.5 in. (800 mm.)	73
C85-12	4	4 1/16 in. × 3⅝ in. (103.2 mm. × 92 mm.)	188 cub. in. (3.08 litres)	85 h.p. at 2,575 r.p.m.	6.3 : 1	184 lb. (83.5 kg.)	32 in. (813 mm.)	31.6 in. (804 mm.)	73
C90-8F	4	4 1/16 in. × 3⅞ in. (103.2 mm. × 98.4 mm.)	201 cub. in. (3.28 litres)	90 h.p. at 2,475 r.p.m.	7.0 : 1	184 lb. (83.5 kg.)	31 in. (787 mm.)	31.5 in. (800 mm.)	80
C90-12F	4	4 1/16 in. × 3⅞ in. (103.2 mm. × 98.4 mm.)	201 cub. in. (3.28 litres)	90 h.p. at 2,475 r.p.m.	7.0 : 1	188 lb. (85.3 kg.)	32 in. (813 mm.)	31.6 in. (804 mm.)	80/87
C145-2	6	4 1/16 in. × 3⅞ in. (103.2 mm. × 98.4 mm.)	301 cub. in. (4.9 litres)	145 h.p. at 2,700 r.p.m.	7.0 : 1	265 lb. (120.3 kg.)	41 in. (1,041 mm.)	31.6 in. (804 mm.)	80/87
O-315-A (Military)	4	5 in. × 4 in. (127 mm. × 101.6 mm.)	315 cub. in. (5 litres)	150 h.p. at 2,600 r.p.m.	7 : 1	261 lb. (118.5 kg.)	28/75 in. (730 mm.)	33.64 in. (854 mm.)	80/87
E185	6	5 in. × 4 in. (127 mm. × 101.6 mm.)	471 cub. in. (7.6 litres)	185 h.p. at 2,300 r.p.m.	7.0 : 1	344 lb. (156.2 kg.)	46.6 in. (1,183 mm.)	33.4 in. (848 mm.)	80/87
E225-4 (O-470-15 (Military)	6	5 in. × 4 in. (127 mm. × 101.6 mm.)	471 cub. in. (7.6 litres)	225 h.p. at 2,650 r.p.m.	7.0 : 1	367 lb. (166.6 kg.)	48.40 in. (1,229 mm.)	33.39 in. (848 mm.)	80/87
O-470-A (Military)	6	5 in. × 4 in. (127 mm. × 101.6 mm.)	471 cub. in. (7.5 litres)	225 h.p. at 2,600 r.p.m.	7 : 1	352 lb. (159.8 kg)	35.75 in. (908 mm.)	33.64 in. (854 mm.)	80/87
SO-470 (Military)	6	5 in. × 4 in. (127 mm. × 101.6 mm.)	471 cub. in. (7.5 litres)	265 h.p. at 2,600 r.p.m.	7 : 1	495 lb. (224.7 kg.)	37.0 in. (940 mm.)	33.39 in. (848 mm.)	80/87

THE CONTINENTAL E185 and E225.

These six-cylinder engines were originally developed under Army supervision but have since been refined for civil use. The E185 develops its rated output of 185 h.p. at 2,300 r.p.m., while the E225 has a normal rating of 225 h.p. at 2,650 r.p.m. Low-pressure fuel injection, drive for vacuum or hydraulic pump, Romec vane fuel pump, and wet or dry sump are optional for both engines. For further particulars see Table.

THE CONTINENTAL O-315-A.

TYPE.—Four-cylinder horizontally-opposed air-cooled.

CYLINDERS.—Bore 5 in. (127 mm.). Stroke 4 in. (101.6 mm.). Capacity 315 cub. in. (5 litres). Compression ratio 7 : 1. Forged steel barrels with integral cooling fins. Heat-treated cast aluminium alloy heads screwed and shrunk on to barrels.

PISTONS.—Aluminium. Three rings, two compression and one oil control. Steel gudgeon pins with circlip retainers.

CONNECTING RODS. Forged steel. Trimetal bronze replaceable type big-end bearings, bronze bush little ends.

CRANKSHAFT.—One-piece four-throw chrome-nickel-molybdenum steel forging. Outer surface nitrided. Three bearings of replaceable shell type.

CRANKCASE.—Two-piece heat-treated aluminium casting divided at vertical lengthwise plane through crankshaft, with integral cast accessory section.

VALVE GEAR.—Two poppet-type valves per cylinder, one steel inlet and one steel exhaust with stellite seat. Camshaft gear-driven from crankshaft in lower part of crankcase.

INDUCTION.—Marvel 3SPA float type carburettor.

FUEL.—80-87 Octane.

IGNITION.—Scintilla type dual magnetos on top of accessory section. Two Champion C27-S spark-plugs per cylinder. Radio shielded ignition harness.

LUBRICATION.—Pressure type. One impeller type pump.

AIRSCREW DRIVE.—Direct R.H. drive. Flanged shaft.

ACCESSORIES.—Diaphragm-type fuel pump. Delco-Remy belt-driven generator. Drives for vacuum pump and tachometer.

STARTING.—Delco-Remy electric starter motor.

MOUNTING.—Four radial-type mounting points, one at each corner of accessory section.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE CONTINENTAL O-470-A.

TYPE.—Six-cylinder horizontally-opposed air-cooled.

CYLINDERS. -Bore 5 in. (127 mm.). Stroke 4 in. (101.6 mm.). Capacity 471 cub. in. (7.5 litres). Compression ratio 7 : 1. Cylinders, etc. same as for O-315-A.

PISTONS AND CONNECTING RODS.—Same as for O-315-A.

CRANKSHAFT.—One-piece six-throw chrome-nickel-molybdenum steel forging. Outer surfaces nitrided. Counterweights attached to rear end of shaft. Five bearings of replaceable shell type.

VALVE-GEAR.—Same as for O-315-A.

INDUCTION.—Marvel MA-4-5 carburettor.

FUEL.—80-87 Octane.

IGNITION AND LUBRICATION.—Same as for O-315-A.

AIRSCREW DRIVE.—R.H. drive. Direct. Special flanged airscrew shaft.

ACCESSORIES.—Delco-Remy generator on accessory section. Drives for vacuum pump and tachometer.

STARTING.—Delco-Remy electric starter motor.

MOUNTING.—Four mounting points one at each lower corner of crankcase.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE CONTINENTAL O-470-B.

The O-470-B is the same as the O-470-A except that the carburettor has been moved from underneath the engine to the rear of the engine, thereby making a flat installation possible.

DIMENSIONS.—
Length 43.81 in. (1,128 mm.).
Width 33.64 in. (854 mm.).
Height 19.62 in. (498 mm.).

THE CONTINENTAL SO-470.

The SO-470 is a supercharged version of the O-470. It is fitted with a belt and gear driven centrifugal blower with a gear ratio of 1 : 2 and a Bendix Model PS7BD carburettor. In most other respects the engine is similar to the O-470-A.

For dimensions, weights and performance see Table.

FRANKLIN

AIRCOOLED MOTORS, INC.

HEAD OFFICE AND WORKS : SYRACUSE 8, N.Y.

President and General Manager : C. F. B. Roth.

Sales Manager : C. H. Bennum.

Service Engineering Manager : W. I. Marble.

Service Parts Manager : F. B. Chadwick.

Chief Engineer : G. T. Bynum.

Aircooled Motors, Inc. produced the first of its very successful series of light horizontally-opposed air-cooled engines in 1938. Up to the outbreak of war it had placed on the market engines of four and six cylinders ranging in output from 65 to 150 h.p.

Aircooled Motors, Inc. has been very active in the development of self-cooled aircraft engines both for helicopter and conventional installations. A cooling-fan is incorporated on some models as an integral part of the engine and together with air housings will permit a totally-submerged engine installation in either the vertical or horizontal position.

The current series of Franklin engines comprise four basic models : one four-cylinder and three six-cylinder models covering a range of 75 to 245 h.p.

FRANKLIN AIRCOOLED ENGINES.

TYPE.—Four or six-cylinder, horizontally-opposed direct-drive air-cooled.

CYLINDERS.—One-piece aluminium-alloy with removable iron liner. Attached to crankcase by integral hold-down flange and studs and nuts.

PISTONS. — Trunk-type, aluminium-alloy permanent-mould. Two compression and one oil ring per piston.

CRANKSHAFT.—One-piece steel forging with SAE standard airscrew shaft flange. Main and connecting-rod bearings steel-backed and copper-lead faced.

CRANKCASE.—Aluminium-alloy in two halves split vertically. Detachable wet oil-sump underneath.

VALVE GEAR.—One overhead inlet and overhead exhaust valve per cylinder actuated by push-rods through rocker-arms with adjustable tappets. Wilcox-Rich hydraulic valve lifters provide zero-clearance regardless of engine temperature. Valve-gear totally enclosed and internally lubricated

CARBURATION.—Marvel-Schebler float-type carburettor with altitude-control and idle cut-off, or Bendix-Stromberg pressure-type non-icing carburettor. Not optional.

REMARKS.—Some models are entirely self-cooled by means of an integral axial-flow fan directly connected to the crankshaft. Air housings are provided which make these engines suitable for submerged installations.

THE FRANKLIN 225.

TYPE.—Four-cylinder horizontally-opposed air-cooled.

CYLINDERS. –Bore 4½ in. (114.3 mm.). Stroke 3½ in. (88.9 mm.). Capacity 225 cub. in. (3.6 litres). Compression ratio 7.0 : 1.

FUEL GRADE. 80 Octane.

ACCESSORIES.—Dual magnetos, float-type carburettor, 12 volt starter, generator. Fuel pump optional.

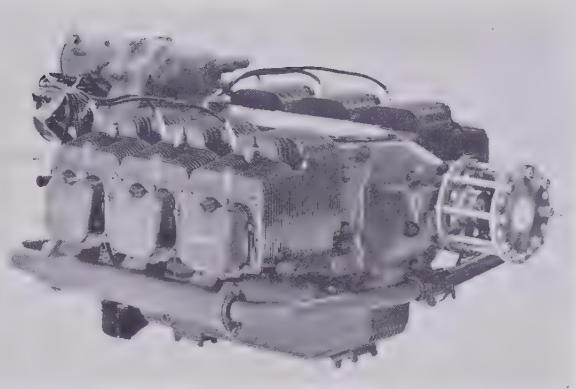
WEIGHT (with starter and generator).—
230 lb. (104.4 kg.).
PERFORMANCE.—
Rated output: 75 h.p. at 1,950 r.p.m. (4A4-75-B3), 85 h.p. at 2,200 r.p.m. (4A4-85-B3), 100 h.p. at 2,550 r.p.m. (4A4-100-B3).

THE FRANKLIN 335.

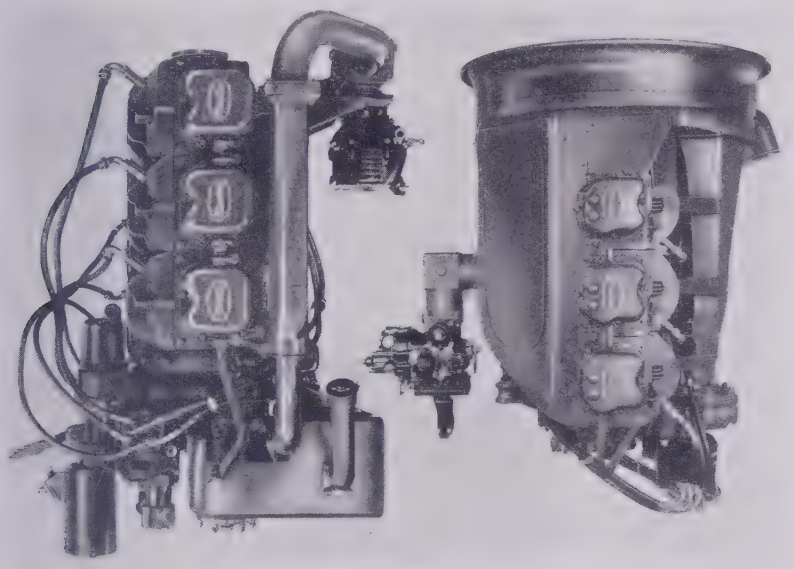
TYPE.—Six-cylinder horizontally-opposed air-cooled.
CYLINDERS.—Bore 4½ in. (114.3 mm.). Stroke 3½ in. (88.9 mm.). Capacity 335 cub. in. (5.5 litres). Compression ratio 7.0 : 1.
FUEL GRADE. –80 Octane.
ACCESSORIES.—Dual magnetos, float-type carburettor, 12-volt starter-generator, oil cooler. Fuel pump optional.
WEIGHTS (with starter, generator and oil-cooler).—
320 lb. (145.3 kg.).
PERFORMANCE.—
Rated output: 130 h.p. at 2,200 r.p.m. (6A4-130-B3), 140 h.p. at 2,375 r.p.m. (6A4-140-B3), 150 h.p. at 2,600 r.p.m. (6A4-150-B3), 165 h.p. at 2,800 r.p.m. (6A4-165-B3), 185 h.p. at 3,100 r.p.m. (6AG4 - 185 - B12 with .632 : 1 reduction gear).

THE FRANKLIN 335 VERTICAL.

TYPE. — Six-cylinder horizontally-opposed air-cooled. Engine operates in vertical position and is designed especially for a helicopter installation.



The 130-165 h.p. Franklin 335 engine.



The Franklin 335 (left) and 425 (right) Vertical helicopter engines.

ACCESSORIES.—Dual magnetos, float or pressure-type carburettor, 12-volt starter, generator, fuel-pump, oil-cooler. Available with or without cooling fan and air housing.
WEIGHT.—
310 lb. (140.7 kg.).
PERFORMANCE.—
Nett rated output: 178 h.p. at 3,000 r.p.m. (6V4-178-B32 and B33) without fan. or 200 h.p. at 3,100 r.p.m. (6V4-200-C32 and C33) using 90/91 octane fuel.

THE FRANKLIN 425 VERTICAL.

TYPE. — Six-cylinder horizontally-opposed air-cooled. Designed specially for helicopter installation and operates in vertical position. Equipped with axial-flow cooling fan and air housing.
CYLINDERS.—Bore 4¾ in. (120.6 mm.). Stroke 4 in. (101.6 mm.). Displacement 425 cub. in. (6.8 litres). Compression ratio 7.5 : 1.
FUEL GRADE. —80 Octane.
DIMENSIONS.—
Width overall 33⅜ in. (845 mm.).
Height overall 38 in. (965 mm.).
Length overall 39⅜ in. (996 mm.).
WEIGHT DRY (with hub accessories).—
352 lb. (160 kg.).
PERFORMANCE (6V6-245-B16F).—
Max. power for take-off 245 h.p. at 3,275 r.p.m.
CONSUMPTIONS.—
Fuel (cruising) .52 lb. (.236 kg.) per h.p./hr.
Oil .002 lb. (.0009 kg.) per h.p./hr.

JACOBS

THE JACOBS AIRCRAFT ENGINE COMPANY.

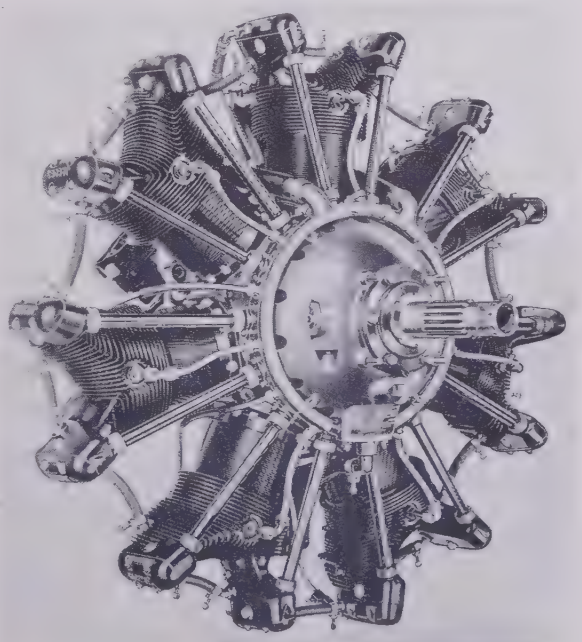
HEAD OFFICE AND WORKS: POTTSTOWN, PENNSYLVANIA.
President: R. Eberstadt.
Vice-President, Treasurer and General Manager: Floyd J. Sisto.
Vice-President in charge of Public Relations: E. F. Gillespie.
Chief Engineer: G. F. Pearson.
Secretary: John C. Banser.

The Jacobs Aircraft Engine Company has been manufacturing aircraft engines since 1929.

The current production engine series is the R-755, which includes the R-755A, R-755B and R-755E. The R-755A which develops 300 h.p. at a power/weight ratio of only 1.68 lb./h.p. (0.72 kg./h.p.) is currently in production for the National Defense Programme. The R-755B has a lower rating and in its B2 form can be fitted with a constant-speed airscrew. The R-755E is a geared version of the R-755A. All engines now incorporate porous chrome-plated cylinder bores and a new type piston and ring assembly giving reduced oil consumption and vastly increased service life.

THE JACOBS R-755A.

TYPE.—Seven-cylinder air-cooled radial.
CYLINDERS.—Bore 5.25 in. (133 mm.) Stroke 5 in. (127 mm.). Capacity 757 cub. in. (12.4 litres). Compression ratio 6 : 1. Barrels machined from steel forging with porous chrome-plated bores. Aluminium-alloy heads screwed and shrunk on. Aluminium-bronze valve-seats shrunk into heads.
PISTONS. — Forged aluminium-alloy. Two compression rings and one scraper ring above gudgeon pin and one scraper ring below. Fully-floating, nitrided gudgeon pins.
CONNECTING RODS.—One-piece steel master-rod with bronze little end bearing and steel-backed lead-bronze big-end bearing. Forged aluminium-alloy link-rods, the aluminium bearing directly on nitrided steel gudgeon pins and knuckle pins.
CRANKSHAFT. — Two-piece clamp type, made from chrome-nickel molybdenum steel forgings. Two main roller bearings, one ball thrust bearing and one ball rear bearing.
CRANKCASE.—Built up of five parts. First, magnesium-alloy front case carrying the thrust ball-bearing and valve-operating gear; second, front half of main crankcase, aluminium-alloy casting which supports the front crankshaft roller-bearing; third, gear half of main crankcase, magnesium-alloy casting, which supports the rear crankshaft roller-bearing and incorporates a ring-type intake manifold; fourth, magnesium-alloy rear plate, which carries additional crankshaft, ball-bearing and supports accessory drives; magnesium-alloy rear case, which carries accessories.
VALVE GEAR.—Two valves per cylinder. The whole valve gear (cam, drive gears, tappets and push-rods) is in the nose section. All moving parts enclosed. Tulip-type inlet valves, and sodium-cooled exhaust valves. Two springs per valve.
CARBURATION. –Single Stromberg NA-R7A carburettor.



The 300 h.p. Jacobs R-755A radial air-cooled engine.

IGNITION.—One Scintilla magneto and one Scintilla battery distributor, incorporating automatic spark advance.
LUBRICATION.—One gear-type pump comprising two pressure sections and one scavenging section. Dry sump. Pressure to all plain bearings. A take-off to operate an adjustable-pitch or constant-speed airscrew can be incorporated. Automatic valve lubrication is standard equipment.
FUEL.—80 octane.
AIRSCREW DRIVE.—R.H. tractor. Direct. No. 20 SAE spline.
ACCESSORY DRIVES.—Drives for airscrew governor, vacuum pump, fuel pump and hydraulic pump.
STARTING.—Eclipse E.80 starter.
DIMENSIONS.
Diameter 44 in. (1,118 mm.).
Length (to rear of mounting plate) 39½ in. (1,006 mm.).
Overall length 40$\frac{7}{32}$ in. (1,020 mm.).
WEIGHT.—
505 lb. (229 kg.).
PERFORMANCE.—
Rated output 300 h.p. at 2,200 r.p.m.

THE JACOBS R-755B.

This engine is basically similar to the R-755A in all particulars except performance. Two versions are available; the R-755B1 which drives a fixed-pitch airscrew, and the R-755B2 which has provision for the installation of a hydraulically-operated constant-speed airscrew. A two-position controllable airscrew can be fitted when a control valve is used.
WEIGHT DRY (R-755B1).—
505 lb. (229 kg.).
WEIGHT DRY (R-755B2).—
511 lb. (232 kg.).
PERFORMANCE.—
Take-off and rated power 275 h.p. at 2,200 r.p.m.

THE JACOBS R-755E.

The R-755E engine is a geared version of the R-755A engine and has the same displacement but a higher rating. Stressed parts are strengthened. Construction is similar to the R-755A except where stated.
TYPE.—Seven-cylinder air-cooled radial, geared.
COMPRESSION RATIO.—6.5 : 1.
CRANKSHAFT.—Clamp type, made of chrome nickel molybdenum steel forgings with two puck-type torsional vibration dampers.
CRANKCASE.—Built up of five parts. First: the front case, a magnesium casting carrying the reduction gears, propeller shaft, and valve tappet assemblies; second, the front main crankcase, an aluminium casting which supports the front main bearing; third, the rear main crankcase, an aluminium casting incorporating the ring-type manifold and the rear main bearing; fourth, magnesium-alloy rear plate which carries an additional crankshaft ball-bearing and supports accessory drives; and fifth, the magnesium-alloy rear case which carries the accessories.
FUEL.—91 Octane.
AIRSCREW DRIVE.—Airscrew is driven at .6491 times crankshaft speed through planetary reduction gear. S.A.E. No. 30 airscrew spline.
DIMENSIONS.—
Diameter 44 in. (1,118 mm.).
Length to rear of mounting plate 29.22 in. (742 mm.).
Overall length 42.3 in. (1,074 mm.).
WEIGHT.—
600 lb. (272 kg.).
PERFORMANCE.—
Take-off and rated power, 350 h.p. at 2,500 r.p.m.

LYCOMING

THE LYCOMING-SPENCER DIVISION OF THE AVCO MANUFACTURING CORPORATION.

HEAD OFFICE: 420, LEXINGTON AVENUE, NEW YORK, N.Y.
PRODUCTION AND SALES OFFICES: WILLIAMSPORT, PENNSYLVANIA.
President: Victor Emanuel.
Vice-President and Treasurer: W. A. Mogensen.
Vice-President (Assistant to President): L. I. Hartmeyer.
Vice-President and General Manager: S. B. Withington.
Sales Manager (Engines): Ray Cowden.
Chief Engineer: C. H. Wiegman.

The Lycoming Division is the aero-engine manufacturing division of the AVCO Manufacturing Corporation which on January 1, 1936, acquired the assets and manufacturing rights of the Aviation Division of the Lycoming Manufacturing Company of Williamsport, Pa.

The first aero-engine to be developed by Lycoming was started in 1928 and was the nine-cylinder radial Model R-680. The first production model, rated at 215 b.h.p., was delivered early in 1931. Regular production of this engine has been discontinued since the war.

Manufacture of the horizontally-opposed air-cooled series was started in 1938 with the 50 h.p. Model O-145. This series of engines now includes five basic models—three four-cylinder, one six-cylinder and one eight-cylinder. These engines are as described hereunder.

THE LYCOMING O-235 and O-290 SERIES.

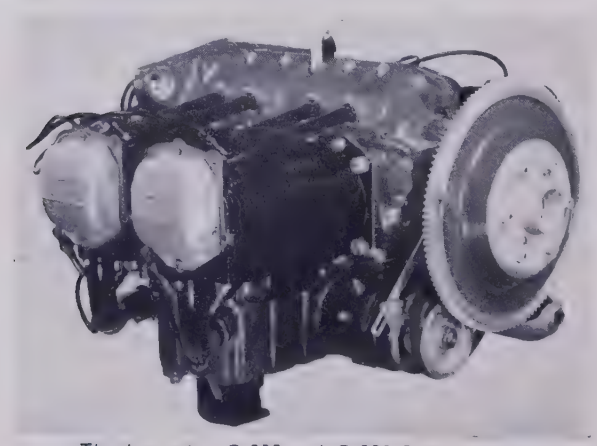
There are two current O-290 Series engines, the O-290-D2 and O-290-D2A. These two engines are the same except that the O-290-D2A incorporates provision for a single-acting hydraulically-controlled propeller and an AN propeller governor drive.
TYPE.—Four-cylinder horizontally-opposed air-cooled.
CYLINDERS.—Bore O-235-C 4$\frac{3}{8}$ in. (111 mm.). O-290-D 4$\frac{7}{8}$ in. (123.7 mm.). Stroke (both) 3$\frac{7}{8}$ in. (98.4 mm.). Aluminium-alloy head screwed and shrunk onto steel barrel. Cylinder assemblies attached to crankcase by studs and nuts.
PISTONS.—Machined from aluminium-alloy forgings O-235 piston has four rings, two compression, an oil regulator and an oil scraper. O-290 has three rings, two compression and one oil regulating. Fully-floating gudgeon-pins with aluminium-alloy retaining plugs.
CONNECTING RODS.—Forged steel. Copper-lead steel-backed precision type bearings. Bronze bushed little ends.
CRANKSHAFT.—One-piece forged steel four-throw shaft on four bearings.
CRANKCASE.—Aluminium-alloy casting split on vertical centre-line. Four precision copper-lead steel-backed main bearings.
VALVE GEAR.—Two valves per cylinder. Inlet valves of Silchrome No. 1, exhaust valves of AMS 5682 with Stellite-faced heads. Value seats of AMS 5700 shrunk into head.
INDUCTION.—Marvel-Schebler MA-3SPA carburetter. Centre zone distribution chamber in oil sump.
IGNITION.—Two Bendix Scintilla SF4LN magnetos, one driven through an impulse coupling.
LUBRICATION.—Full pressure wet sump type.
ACCESSORIES.—Starter, generator and tachometer drive. Starter is an automotive type located at front and cranks engine through a Bendix drive which engages with a gear integral with rear airscrew flange. Automotive generator also at front of engine and driven by belt and pulley. Optional drives for fuel pump and vacuum pump can be supplied. Pads for these optional drives mounted on rear of engine.
DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE LYCOMING O-320.

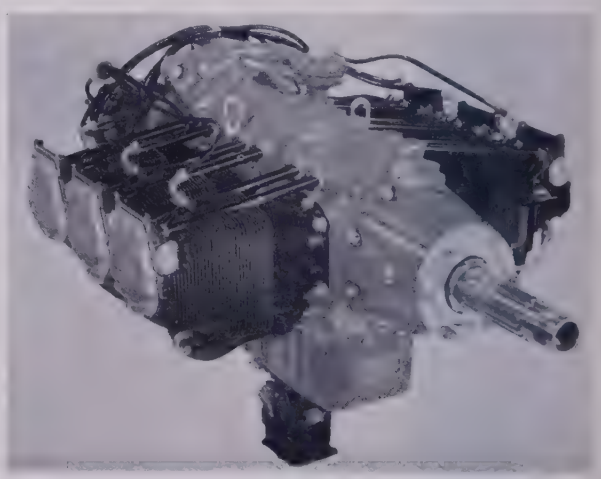
The O-320 is basically the same as the O-290 except for an increase in cylinder bore to 5$\frac{1}{8}$ in. (130 mm.) with a corresponding increase in swept volume to 319.8 cub. in. (5.2 litres). For other details see Table.

THE LYCOMING O-435 SERIES.

The O-435 Series includes direct-drive, geared and geared and supercharged models, details of which will be found in the Table. The GSO-435-B2 is the same as the GSO-435-B except for an AN propeller governor drive mounted on the left side of propeller reduction gear housing. This increases the length of the engine by 0.47 in. and the engine weight to 496 lb. (225.1 kg.).
TYPE.—Six-cylinder horizontally-opposed air-cooled incorporating the major components of O-290.
CYLINDERS.—Bore 4$\frac{7}{8}$ in. (123.7 mm.). Stroke 3$\frac{7}{8}$ in. (98.4 mm.).
PISTONS.—Aluminium-alloy pistons with two compression and two oil control rings.
CRANKCASE.—Aluminium-alloy casting split on the vertical centre-line. Additional ball-thrust bearing at forward end of case.
INDUCTION.—Marvel-Schebler single barrel carburettor attached to bottom of oil sump casting. The distributing zone is submerged in oil. Separate induction pipes lead to inlet valves.
IGNITION.—Dual Scintilla magnetos driven by spur gears from the timing gear.
LUBRICATION.—Full pressure type, including valve mechanism. Crankshaft equipped with centrifugal sludge-removers. Pistons, gudgeon pins and accessory drive gears lubricated by splash.



The Lycoming O-235 and O-290 Series engine.



The 240 h.p. Lycoming GO-435 geared engine.

ACCESSORIES.—Starter, generator and single tachometer are standard. In addition drives for fuel pump, vacuum pump, generator and dual tachometers can be supplied.
DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE LYCOMING GSO-580 SERIES.

Current GSO-580 Series engines are the GSO-580-C and GSO-580-D (Military designation XO-580-1). Details of both these engines will be found in the Table. The GSO-580-C is identical to the GSO-580-D except that it is rated on 91/96 Grade fuel at 375 h.p. at 3,300 r.p.m. for take-off and 320 h.p. at 3,000 r.p.m. maximum continuous.

A Model SO-580-D is the same as the GSO-580-D less the reduction gear, for helicopter use. The length of this engine is 49.20 in. (1,250 mm.) and the weight 560 lb. (254.2 kg.).

TYPE.—Eight-cylinder horizontally-opposed air-cooled, geared and supercharged.
CYLINDERS.—Bore $4\frac{7}{8}$ in. (123.7 mm.). Stroke $3\frac{7}{8}$ in. (98.4 mm.). Displacement 578 cub. in. (10.4 litres). Compression ratio 7.30 :1. Aluminium-alloy heads, with 50% increase in fin area over previous Lycoming head design, screwed and shrunk onto steel barrels. Cylinder assemblies attached to crankcase by studs and nuts.
PISTONS.—Forged aluminium pistons with three rings above gudgeon pin and one below. Top ring is a compression ring, wedge type, chrome plated. Second ring, also compression type, is cast iron wedge type. Third ring is an oil regulating ring. Fourth ring is an oil scraper below fully-floating gudgeon pin.
CRANKCASE.—Two machined aluminium-alloy castings joined on vertical centre-line by through bolts and studs.
CRANKSHAFT.—Eight-throw shaft on five main bearings. Fitted with four pairs of dynamic dampers tuned to crankshaft torsional period to eliminate fourth order torsional vibration.
CARBURATION.—Pressure-type Bendix carburettor Model PSH-9BDE with altitude control and solenoid primer.
SUPERCHARGER.—Centrifugal type supercharger with a single outlet directly connected to central distributing zone with four Y-type intake pipes connecting distributing zone to cylinders. Rates 7.9 : 1.
IGNITION.—Two Scintilla SF8LN magnetos.
LUBRICATION.—Full-pressure dry sump.
ACCESSORIES.—Pads for mounting starter, generator, fuel pump, hydraulic pump, vacuum pump and tachometer.
DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

LYCOMING HORIZONTALLY-OPPOSED ENGINES.

Engine Model	No. of Cylinders	Rated output at Sea level	Capacity	Compression Ratio	Octane No.	Weight Dry	Overall Length	Overall Width	Overall Height	Gear Ratio
O-235-C1	4	108 h.p. at 2,600 r.p.m. (T.O. 115 h.p. at 2,800 r.p.m.)	233 cub. in. (3.85 litres)	6.75 : 1	80/87	235 lb. (106.6 kg.)	29.56 in. (751 m/m.)	32.00 in. (812 m/m.)	22.53 in. (570 m/m.)	Direct
O-290-D2	4	135 h.p. at 2,600 r.p.m. (T.O. 140 h.p. at 2,800 r.p.m.)	289 cub. in. (3.85 litres)	7.5 : 1	80/87	260 lb. (118 kg.)	30.09 in. (764 m/m.)	32.24 in. (819 m/m.)	22.81 in. (579 m/m.)	Direct
O-320	4	150 h.p. at 2,700 r.p.m.	319.8 cub. in. (5.2 litres)	7.25 : 1	80/87	268 lb. (121.6 kg.)	30.09 in. (764 m/m.)	32.24 in. (819 m/m.)	24.68 in. (627 m/m.)	Direct
O-435-A	6	190 h.p. at 2,550 r.p.m.	434 cub. in. (7.1 litres)	6.5 : 1	80/87	392 lb. (177.9 kg.)	38.10 in. (967 m/m.)	32.24 in. (817 m/m.)	29.59 in. (751 m/m.)	Direct
O-435-A2	6	225 h.p. at 3,000 r.p.m.	434 cub. in. (7.1 litres)	7.5 : 1	91/98	392 lb. (177.9 kg.)	38.10 in. (967 m/m.)	32.24 in. (817 m/m.)	29.59 in. (751 m/m.)	Direct
O-435-H	6	195 h.p. at 2,600 r.p.m. (T.O. 200 h.p. at 2,800 r.p.m.)	434 cub. in. (7.1 litres)	7 : 1	80/87	362 lb. (164.3 kg.)	37.50 in. (952 m/m.)	32.24 in. (819 m/m.)	24.65 in. (626 m/m.)	Direct
O-435-K1 (O-435-4 military)	6	250 h.p. at 3,200 r.p.m. (T.O. 260 h.p. at 3,400 r.p.m.)	434 cub. in. (7.1 litres)	7.3 : 1	80/87	405 lb. (183.8 kg.)	—	—	—	Direct
GO-435-C2	6	240 h.p. at 3,000 r.p.m. (T.O. 260 h.p. at 3,400 r.p.m.)	434 cub. in. (7.1 litres)	7.3 : 1	80/87	422 lb. (191.5 kg.)	39.57 in. (1,005 m/m.)	33.12 in. (843 m/m.)	29.59 in. (751 m/m.)	.642 : 1
GSO-435-B	6	260 h.p. at 3,050 r.p.m. (T.O. 300 h.p. at 3,400 r.p.m.)	434 cub. in. (7.1 litres)	7.3 : 1	91/96	488 lb. (221.5 kg.)	45.75 in. (1,162 m/m.)	33.12 in. (843 m/m.)	32.24 in. (817 m/m.)	.642 : 1
GSO-580-C	8	320 h.p. at 3,000 r.p.m. (T.O. 375 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	91/98	560 lb. (254.2 kg.)	49.20 in. (1,250 m/m.)	33.18 in. (843 m/m.)	34.22 in. (869 m/m.)	.642 : 1
GSO-580-D (XO-580-1 military)	8	350 h.p. at 3,000 r.p.m. (T.O. 400 h.p. at 3,300 r.p.m.)	578 cub. in. (10.4 litres)	7.3 : 1	100/130	604 lb. (274.2 kg.)	57.08 in. (1,450 m/m.)	33.18 in. (843 m/m.)	34.22 in. (869 m/m.)	.642 : 1

McCULLOCH

McCULLOCH MOTORS CORPORATION.

HEAD OFFICE AND WORKS: LOS ANGELES 45, CALIFORNIA.

President: Robert P. McCulloch.

Vice-President and Chief Engineer: John L. Ryde.

Vice-President in charge of Tooling: Gerald Robechaud.

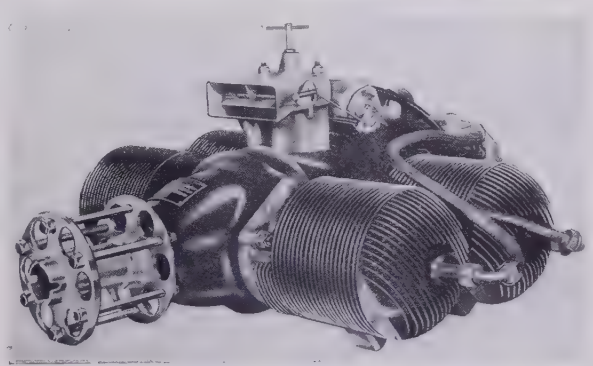
Vice-President in charge of Sales: C. F. Breer.

Vice-President in charge of Production: S. G. Egbert.

Secretary and Treasurer: Joseph L. Hegener.

McCulloch Motors Corpn. produces a variety of gasoline-engined products, making extensive use of high-pressure die casting of aluminium and magnesium.

Since 1943 the company has been producing engines for use in radio-controlled target aircraft. The latest engine, the Model 4318A, which is in production for the armed forces, is described and illustrated below. This engine can be fitted with a two-position throttle operated by a rotary solenoid. This solenoid is connected to a radio receiver in the aeroplane, thereby enabling the throttle control to be responsive to remote radio signals.



The 72 h.p. McCulloch four-cylinder two-stroke engine.

THE McCULLOCH MODEL 4318A.

TYPE.—Four-cylinder horizontally-opposed air-cooled two-stroke.
CYLINDERS.—Bore $3\frac{3}{16}$ in. (80.8 mm.). Stroke $3\frac{1}{8}$ in. (79.4 mm.). Displacement 100 cub. in. (1.6 litres). Compression ratio 8 : 1. Heat-treated die-cast aluminium cylinders with hard chrome plated cylinder walls. Self-locking nuts secure cylinders to crankcase studs.
PISTONS.—Heat-treated cast aluminium. Two rings. Piston pins of case-hardened steel.
CONNECTING RODS.—Forged steel. Split big-end carries bearing rollers in beryllium copper cage. Small-end carries two needle bearings.

CRANKSHAFT.—Four-throw one-piece steel forging on four anti-friction bearings, two ball, one needle and one split needle bearing at centre of crankshaft.

CRANKCASE.—One-piece aluminium casting closed at rear end with cast aluminium cover which provides mounting for magneto.

FUEL SYSTEM.—McCulloch diaphragm-type carburettor A.C. diaphragm type fuel pump. Fuel mixture for scavenging and power stroke introduced to cylinders through rotary valves on crankshaft.

FUEL GRADE.—Grade 115/145 aviation fuel mixed with lubricating oil as in conventional two-cycle engines.

IGNITION.—McCulloch single magneto and distributor. Directly connected to crankshaft through impulse coupling for easy starting. Radio noise suppressor included. BG spark plugs. Complete radio shielding.

MOUNTING.—Three mounting lugs provided with sockets for rubber mounting bushings.

AIRSCREW DRIVE.—Direct. R.H. tractor.

DIMENSIONS.—
Overall diameter 27.0 in. (68.6 cm.).
Overall length 26.25 in. (66.7 cm.).

WEIGHT (complete, but less airscrew hub).—76.5 lb. (34.7 kg.).

PERFORMANCE.—
Rated output 72 h.p. at 4,100 r.p.m.

PRATT & WHITNEY

THE PRATT & WHITNEY AIRCRAFT DIVISION OF UNITED AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS: EAST HARTFORD 8, CONNECTICUT.

Established: 1925.

General Manager: William P. Gwinn.

Engineering Manager: Wright A. Parkins.

Chief Engineer: Perry W. Pratt.

Sales Manager: T. E. Tillinghast.

Factory Manager: John L. Bunce.

Pratt & Whitney concentrates on the manufacture of high-powered radial air-cooled engines and gas-turbines. It was founded in 1925 by a small group of aeronautical engine experts as the Pratt & Whitney Aircraft Company and has since become affiliated as a division of the United Aircraft Corporation.

During 1952, Pratt & Whitney Aircraft retained and strengthened its position of leadership in the development and manufacture of gas-turbine piston-type aircraft engines.

In the early Autumn of 1950, a major expansion of Pratt & Whitney production capacity got under way with the re-occupation of the Southington, Conn. plant, which the company operated during the last war, and the stepping-up of production at the East Hartford plant by increasing employment and the introduction of a three-shift 48-hour week. To provide an additional million square feet of production area Pratt & Whitney have taken over and enlarged the Hamilton Standard plant in East Hartford and has built a new satellite plant at North Haven, Conn. In January, 1953, employment in all Pratt & Whitney plants was over 29,500 and this figure was expected to increase to 33,500 by the second quarter of 1953.

Pratt & Whitney have licenced the Ford Motor Company to build the R-4360 "C" Series engine in a Government-owned plant in Chicago, and the Nash-Kelvinator Corporation to build the R-2800 Double-Wasp in its Kenosha and Milwaukee, Wis., plants. These licences have been granted without fee.

The R-985 Wasp Junior is no longer in production and the R-1340 Wasp engine is now only being manufactured by the Canadian Pratt & Whitney company. The first Canadian-built R-1340 engine was completed in December, 1952.

In 1952 nearly half of Pratt & Whitney production capacity was devoted to gas turbine engines. Details of these engines will be found in Part I of this Section.

THE PRATT & WHITNEY R-2000 TWIN-WASP D SERIES.

TYPE.—Fourteen-cylinder two-row air-cooled radial.

CYLINDERS.—Bore 5¾ in. (146 mm.). Stroke 5½ in. (139.50 mm.). Displacement 2,004 cub. in. (32.8 litres). Built up of cast aluminium head, with integral valve mechanism housing, screwed and shrunk on a forged steel cylinder barrel. Forged aluminium sleeve in which deep-cut cooling fins have been machined (muffs) are shrunk over the central portion. Each cylinder has one inlet and one exhaust valve, seating on inserts which are shrunk into head. Pressure baffles are provided.

PISTONS.—Of forged aluminium, ribbed on underside of head for additional cooling. Each piston has three compression-rings, one oil scraper-ring and one pair of dual oil control rings.

CONNECTING RODS.—The master rod cluster consists of the master rod, with detachable cap and two piece lead-silver bearing, and six I-section articulated rods for each row. Each articulated rod has bronze bushings at both piston and knuckle pin ends.

CRANKSHAFT.—Forged steel, two-throw counter-weighted, one-piece type, supported by three plain lead-silver bearings in the crankcase section.

CRANKCASE.—Made up of seven sections. The three parts for the power section, or crankcase proper, are machined together from aluminium forgings. The magnesium nose section houses the reduction gears and has provision for the Hamilton Standard Hydromatic or other full-feathering airscrews. The power sections are joined by through bolts. The magnesium blower section, bolted to the power section, contains the supercharger and carries bronze-bushed forged-steel engine mounting lugs. The blower intermediate section, bolted to the blower section, supports the downdraft carburettor and houses the impeller gear train. The accessory section, also of magnesium, is fastened to the lower intermediate section by means of stud bolts.

VALVE GEAR.—One inlet and one exhaust valve per cylinder. Exhaust valves are sodium-cooled and faced with stellite. Valves are actuated by plain bearing rocker arms and push-rods. Two shelf-mounted cams, one in front power section and one in rear, driven by spur reduction gears directly off the crankshaft at one-eighth crankshaft speed.

INDUCTION SYSTEM.—Stromberg pressure-injection carburettor with automatic mixture control, idle cut-off, primer tubing and distributor. Metered fuel is carried through internal passage and is thrown centrifugally through small holes in a slinger ring mounted on the impeller drive shaft. Combustion air enters the supercharger at right angles to the screen of vaporized fuel thrown from the slinger ring. Fuel air mixture after being compressed collects in the blower rim from where it is carried through intake pipes to the individual cylinders. The "washboard" impeller case provides better fuel vaporization, preventing the accumulation and flow of liquid fuel along the wall by returning it to the air stream.

SUPERCHARGER.—Either single-speed or two-speed, and is single stage. Impeller is driven by spring-loaded flexible drive gears to absorb shocks and to equalize driving loads, plus cone clutches with creeper desludgers in the case of two-speed drive engines.

IGNITION SYSTEM.—Two nose-mounted Scintilla magnetos each operate an individual set of spark-plugs through a single ignition manifold attached to the front of the power section. Magnetos, manifold and spark-plug leads are radio-shielded.

LUBRICATION.—Forced feed lubrication by a gear-type oil pump to all parts of the engine.

REDUCTION GEAR.—The planetary reduction gears of Pratt & Whitney design. Ratio .500 : 1. Airscrew shaft supported at the crankshaft end in two concentric bearings mounted in a support plate at the rear of the nose housing and at the front of the nose section by a deep-groove ball-bearing. The airscrew shaft is completely decoupled from the crankshaft.

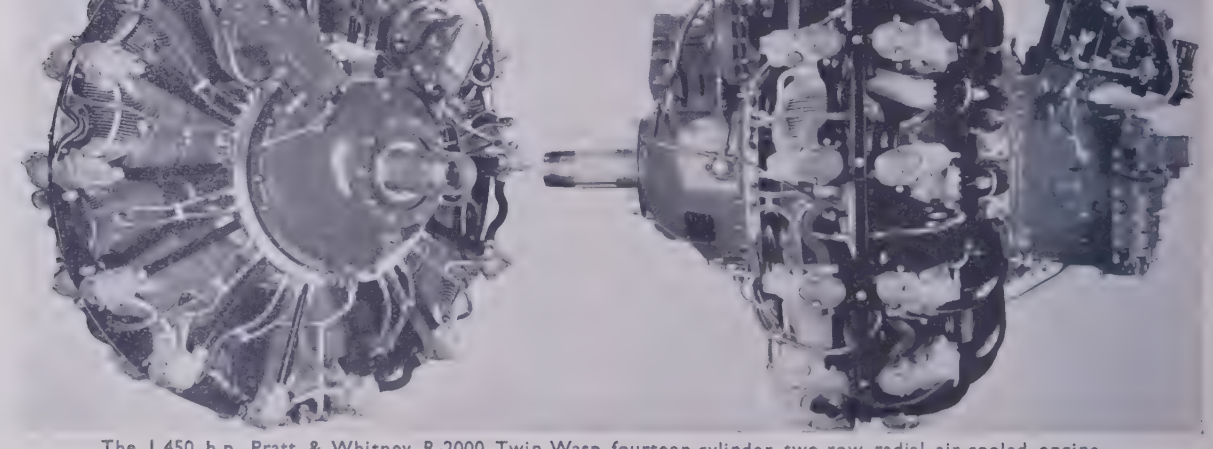
ACCESSORY DRIVES.—All accessories are grouped in the rear and are driven through intermediate gear train by a single drive-shaft spline fitted to the rear of the crankshaft.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE PRATT & WHITNEY R-2800 DOUBLE WASP CA AND CB SERIES.

TYPE.—Eighteen-cylinder two-row air-cooled radial.

CYLINDERS.—Bore 5¾ in. (146 mm.). Stroke 6 in. (152.4 mm.). Capacity 2,804 cub. in. (45.9 litres). Built up of forged aluminium head, with integral valve mechanism housing, screwed and shrunk on a forged steel



The 1,450 h.p. Pratt & Whitney R-2000 Twin-Wasp fourteen-cylinder two-row radial air-cooled engine.

THE PRATT & WHITNEY TWIN WASP R-2000 D SERIES.

Engine Model	Take-off Power	Normal Rating (low blower)	Normal Rating (high blower)	Max. Continuous Power	Compression Ratio	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
D5	1,450 h.p. at 2,700 r.p.m. at 2,800 ft. (855 m.)	1,200 h.p. at 2,550 r.p.m. at 6,400 ft. (1,952 m.)	—	—	6.5 : 1	7.15 : 1	.500 : 1	1,585 lb. (719 kg.)	49.10 in. (1.247 m.)	100/130
2SD13-G	1.450 h.p. at 2,700 r.p.m. at 1,000 ft. (305 m.)	1,200 h.p. at 2,550 r.p.m. at 5,000 ft. (1,525 m.)	1,100 h.p. at 2,550 r.p.m. at 14,000 ft. (4,265 m.)	—	6.5 : 1	7.15 : 1 (L) and 9.52 : 1 (H)	.500 : 1	1.605 lb. (728 kg.)	49.10 in. (1.247 m.)	100/130

cylinder barrel. Forged aluminium sleeves in which deep-cut cooling fins have been machined, are shrunk over the central portion. Each cylinder has one inlet and one exhaust valve, the inlet seating on a bronze insert and the exhaust on a steel insert, both of which are shrunk into the head. Pressure baffles are provided.

PISTONS.—Forged aluminium pistons of full skirt type. Three compression rings, one pair of dual oil control rings and one oil scraper ring. Top compression ring chromium plated on the face which bears against the cylinder wall.

CONNECTING RODS.—The rod assembly consists of a one-piece master rod and eight I-section articulated rods attached to each master rod by knuckle pins. The master rod bearings are one-piece steel shells covered on the inside and outside with leaded silver. The articulated rods have bronze bushings at the piston pin end and ride on silvered knuckle pins at the knuckle pin end.

CRANKSHAFT.—Two-throw crankshaft machined from three steel forgings which divide at the crankpins and are joined together by a face spline and bolt. Crankshaft assembly supported by steel-backed lead-silver bearings mounted in the front, centre and rear main crankcase sections. Weights of reciprocating and rotating parts connected to the crankpin are counterbalanced by weights, the front counter balance and a portion of the improved rear one being mounted as bifilar dampers. Mounted at each end of the crankshafts are two counterweights revolving at twice-crankshaft speed to eliminate second-order "whirl."

CRANKCASE.—Main crankcase composed of three forged aluminium-alloy sections held together by through bolts. Nose-section houses the reduction gears and torquemeter and has provisions for full-feathering, reversible governor. Supercharger case attached to the rear of the main crankcase section and also houses an impeller. Intermediate rear case is attached to supercharger case and supports at its forward face a vaned diffuser plate and provides mounting surface for a pressure type carburettor. Rear section provides accessory mounting pads.

REMARKS.—The valve gear, induction-system, supercharger, ignition system, lubrication system and accessory-drives are substantially the same as in the Twin-Wasp. The ignition system is optionally high or low voltage. Water-injection equipment may be used with the "CA" Double-Wasp to give the added power for take-off and emergencies.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

THE PRATT & WHITNEY R-4360 WASP MAJOR CB SERIES.

TYPE.—Twenty-eight-cylinder four-row air-cooled radial.

CYLINDERS.—Bore 5¾ in. (146 mm.). Stroke 6 in. (152.4 mm.). Capacity 4,363 cub. in. (71.5 litres). Cylinders, which are similar to those of R-2800 Series, are arranged helically around the crankcase and pressure baffles are provided for individual cylinders and for each bank of four. All cylinders are completely interchangeable.

PISTONS.—Generally the same as for the Double Wasp, with reinforced internal bosses.

CONNECTING RODS.—Rod assembly for each row of seven cylinders consists of master rod with detachable cap, two-piece lead-silver bearing, and six I-section articulated or link rods. Each link rod has a bronze bushing at the piston end and rides on a silvered knuckle pin.

CRANKSHAFT.—One-piece crankshaft of forged steel has four throws and is supported in the crankcase by five steel-backed lead-silver main bearings. Weights of the reciprocating parts connected to the crankpin are counterbalanced by two fixed and two bifilar counterweights.

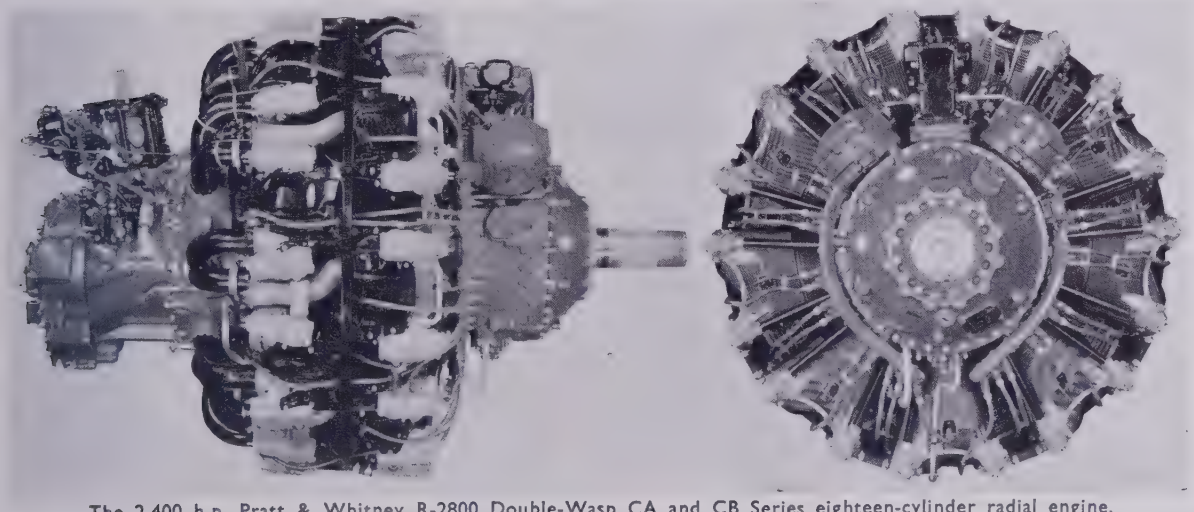
AIRSCREW SHAFT.—Supported at the crankshaft end by a plain lead-bronze bearing and at the airscrew end by a roller-bearing to carry radial loads and a deep-groove ball-bearing which absorbs engine thrust.

CRANKCASE.—The power section case made up of five sections, all except the front and rear sections being substantially alike. The parts for the power section are machined from aluminium forgings and are held together with through bolts. All other crankcase sections are magnesium castings. Attached to front of power section by studs is the magneto section, which mounts seven interchangeable magnetos and contains the torquemeter. The nose section houses the planetary reduction gearing and has provision for full-feathering, reversible airscrew governor. Attached to rear of power section by studs is the supercharger housing, enclosing the supercharger drives and impeller. Behind the supercharger housing, also attached with studs, is the accessory section. On this is mounted a down-draft pressure-type carburettor. This section houses the accessory-drive mechanism and provides mounting pads for the radial mounting of all accessories and automatic power controls to permit greater accessibility for servicing. Normally nothing is mounted on the rear of the engine but a co-axial accessory drive may be provided as optional equipment.

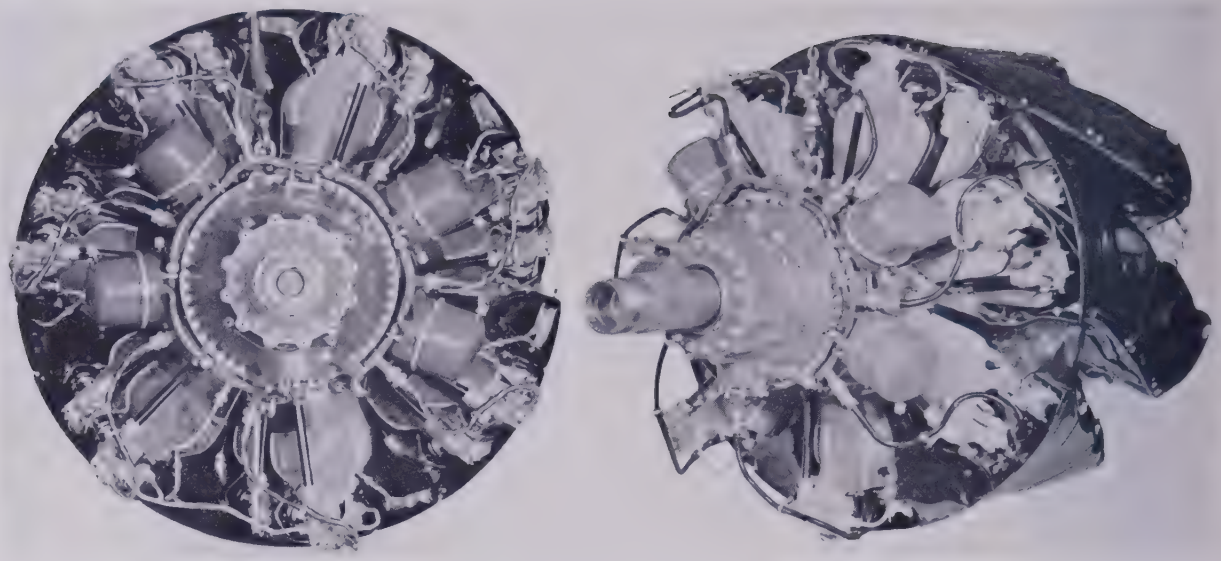
THE PRATT & WHITNEY R-4360 WASP MAJOR CB SERIES.

Engine Model	Take-off Power	Normal Rating	Max. Continuous Power	Compression Ratio	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
CB2	‡3,500 h.p. at 2,700 r.p.m. at 500 ft. (150 m.) 3,250 h.p. at 2,700 r.p.m. at 700 ft. (215 m.)	2,650 h.p. at 2,550 r.p.m. at 5,500 ft. (1,675 m.)	2,800 h.p. at 2,550 r.p.m. at 3,500 ft. (1,070 m.)	6.7 : 1	6.375 : 1	.375 : 1	3,670 lb. (1,665 kg.)	55 in. (1,397 mm.)	108/135

‡ With water injection. Note: The CB2 Model is suitable for use with exhaust-driven supercharger.



The 2,400 h.p. Pratt & Whitney R-2800 Double-Wasp CA and CB Series eighteen-cylinder radial engine.



The 3,350 h.p. Pratt & Whitney R-4360 CB Series four-row radial air-cooled engine.

Valve Gear.—Rocker boxes are part of the cylinder head, extending fore and aft. Rocker arms with plain bearings are actuated by enclosed push-rods. Double-track shelf-mounted cams inside the crankcase between the rows of cylinders operate the exhaust valves of the forward row of cylinders and the intake valves of the aft row. Cams are driven by spur reduction-gears from the crankshaft at one-sixth crankshaft speed.

Induction System.—Stromberg four-barred pressure-type carburettor, with automatic mixture control, idle cut-off, primer tubing and distributor. Metered fuel is carried through internal passages and is thrown centrifugally through small holes between the impeller blades to mix with the combustion air. The fuel-air mixture, after passing through the diffuser to the blower rim, is carried to the cylinders through seven intake pipes, one for each bank of four cylinders.

Supercharger.—There are two basic types

THE PRATT & WHITNEY R-2800 DOUBLE WASP CA AND CB SERIES.

Engine Model	Take-off Power	Normal Rating (low blower)	Normal Rating (high blower)	Max. Continuous Power (low blower)	Max. Continuous Power (high blower)	Blower Ratio	Gear Ratio	Weight Dry	Diameter	Fuel Grade
*CA3	‡2,400 h.p. at 2,800 r.p.m. 2,100 h.p. at 2,800 r.p.m. at 3,000 ft. (915 m.)	1,800 h.p. at 2,600 r.p.m. at 6,000 ft. (1,830 m.)	—	1,900 h.p. at 2,600 r.p.m. at 4,000 ft. (1,220 m.)	—	7.29 : 1	.45 : 1	2,317 lb. (1,051 kg.)	52.8 in. (1,342 mm.)	100/130
†CA15	‡2,400 h.p. at 2,800 r.p.m. 2,100 h.p. at 2,800 r.p.m. at 3,000 ft. (915 m.)	1,800 h.p. at 2,600 r.p.m. at 6,000 ft. (1,830 m.)	1,600 h.p. at 2,600 r.p.m. at 16,000 ft. (4,880 m.)	1,900 h.p. at 2,600 r.p.m. at 4,000 ft. (1,220 m.)	1,600 h.p. at 2,600 r.p.m. at 16,000 ft. (4,880 m.)	7.29 : 1 (L) 9.45 : 1 (H)	.45 : 1	2,350 lb. (1,066 kg.)	52.8 in. (1,342 mm.)	100/130
†CA18	‡2,400 h.p. at 2,800 r.p.m. 2,100 h.p. at 2,800 r.p.m. at 3,000 ft. (905 m.)	1,800 h.p. at 2,600 r.p.m. at 6,000 ft. (1,830 m.)	1,600 h.p. at 2,600 r.p.m. at 14,500 ft. (4,420 m.)	1,900 h.p. at 2,600 r.p.m. at 4,000 ft. (1,220 m.)	1,675 h.p. at 2,600 r.p.m. at 13,500 ft. (4,115 m.)	7.29 : 1 (L) 9.1 : 1 (H)	.45 : 1	2,350 lb. (1,066 kg.)	52.8 in. (1,342 mm.)	100/130
*CB3	‡2,400 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.) 2,050 h.p. at 2,700 r.p.m. at 6,000 ft. (1,830 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	—	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	—	7.29 : 1	.45 : 1	2,357 lb. (1,070 kg.)	52.8 in. (1,342 mm.)	100/130
*CB4	‡2,500 h.p. at 2,800 r.p.m. at 2,500 ft. (760 m.) 2,200 h.p. at 2,800 r.p.m. at 4,500 ft. (1,370 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	—	1,900 h.p. at 2,600 r.p.m. at 7,000 ft. (2,135 m.)	—	7.29 : 1	.45 : 1	2,357 lb. (1,070 kg.)	52.8 in. (1,342 mm.)	108/135
†CB16	‡2,400 h.p. at 2,800 r.p.m. at 4,000 ft. (1,220 m.) 2,050 h.p. at 2,700 r.p.m. at 6,000 ft. (1,830 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	1,600 h.p. at 2,600 r.p.m. at 16,000 ft. (4,880 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	1,700 h.p. at 2,600 r.p.m. at 14,500 ft. (4,420 m.)	7.29 : 1 (L) 8.58 : 1 (H)	.45 : 1	2,390 lb. (1,084 kg.)	52.8 in. (1,342 mm.)	100/130
†CB17	‡2,500 h.p. at 2,800 r.p.m. at 2,500 ft. (760 m.) 2,200 h.p. at 2,800 r.p.m. at 4,500 ft. (1,370 m.)	1,800 h.p. at 2,600 r.p.m. at 8,500 ft. (2,590 m.)	1,700 h.p. at 2,600 r.p.m. at 14,500 ft. (4,420 m.)	1,900 h.p. at 2,600 r.p.m. at 7,000 ft. (2,135 m.)	1,750 h.p. at 2,600 r.p.m. at 13,500 ft. (4,115 m.)	7.29 : 1 (L) 8.58 : 1 (H)	.45 : 1	2,390 lb. (1,084 kg.)	52.8 in. (1,342 mm.)	108/135

* Single-speed single-stage supercharger. † Two-speed single-stage supercharger. ‡ With water injection.

in unrestricted engines: a single-stage single-speed supercharger suitable for use with an exhaust driven turbo-supercharger, and a single-stage hydraulically-driven variable-speed supercharger. The two-piece impeller assembly consists of a machined impeller, the straight blades of which are blended with the curved entrance blades of an inducer.

IGNITION SYSTEM.—Four Scintilla magnetos, each with an integral distributor, operate at one-half crankshaft speed. Dual ignition.

LUBRICATION.—Forced-feed lubrication provided by a gear-type oil pump to all parts of the engine.

REDUCTION GEAR.—The planetary reduction gears are of Pratt & Whitney design and are spur gears with ratio of .375 : 1.

ACCESSORY DRIVES.—All accessories mounted radially on the periphery of the rear section. All accessory-drive gears driven by a bevel-gear revolving at crankshaft speed.

DIMENSIONS, WEIGHTS AND PERFORMANCE.—See Table.

WRIGHT

WRIGHT AERONAUTICAL DIVISION, CURTISS-WRIGHT CORPORATION.

HEAD OFFICE AND WORKS: WOODRIDGE, N.J.

Chairman of the Board and President: Roy T. Hurley.

Vice-President and General Manager: E. M. Powers.

Vice-President and Chief Engineer: W. G. Lundquist.

The Wright Aeronautical Corporation merged with the Curtiss Aeroplane and Motor Company in 1929 to form the Curtiss-Wright Corporation, of which Wright is now the largest division.

Wright piston engines range in power from 800 to 2,700 horsepower, while the Wright Turbo Compound, a combination piston and turbine engine which develops over 3,500 h.p., is also in quantity production and is the only compound engine powering production aircraft.

All Lockheed Constellation airliners are powered by four Wright eighteen-cylinder R-3350 engines. The new Turbo Compound engine powers the Lockhhed P2V and WV-2 and Martin P5M patrol aircraft and the Lockheed R7V-1 transport in service in the U.S. Navy, as well as the Fairchild C-119H and Lockheed C-121 transports of the U.S.A.F. The Turbo Compound has also been selected to power the later versions of the Super Constellation and the new Douglas DC-7 airliner.

Wright is also in production with the J65 Sapphire turbojet for installation in the Republic F-84F, the Martin B-57A Canberra and other advanced types of military aircraft.

In addition to the further development of existing power-units and a series of turbojet and turboprop engines, Wright is also actively engaged in a ramjet development programme for guided missile application. What details are available on the Wright J65 will be found in Part I of this Section.

THE WRIGHT R-1300 CYCLONE 7 SERIES.

TYPE.—Seven-cylinder radial air-cooled.

CYLINDERS.—Bore 6.125 in. (155.6 mm.). Stroke 6.312 in. (160.2 mm.). Capacity 1,300 cub. in. (21.4 litres). Compression ratio 6.2 : 1. Nitrided forged-steel barrels with K-type aluminium cooling-fins inserted into grooves machined in barrel. Cylinder-head forged aluminium-with machine-cut fins giving greater cooling and high tensile strength. Head screwed and shrunk to barrel.

PISTONS.—High tensile aluminium-alloy forgings.

CONNECTING RODS.—One forged steel master-rod of the solid big-end type with steel-backed anti-friction bearing. Six H-section articulated rods.

CRANKSHAFT.—Single-throw two-piece forged steel crankshaft dynamically dampened.

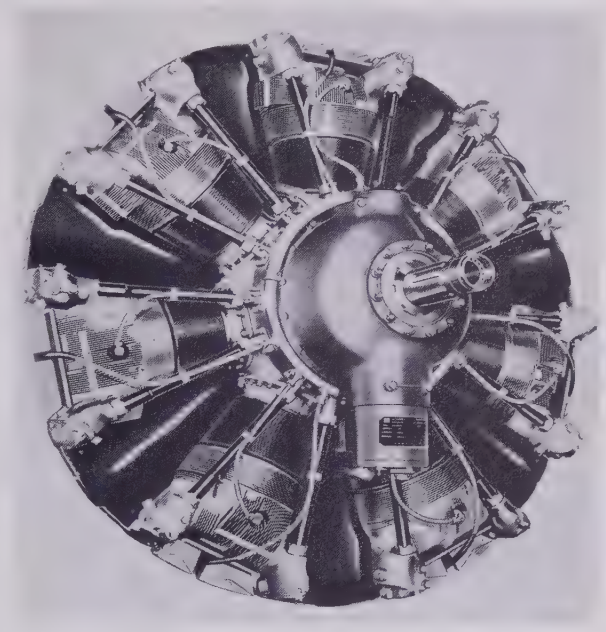
CRANKCASE.—Cylindrical forged steel two-piece power section with front and rear sections of magnesium-alloy. Front section houses reduction gearing and rear sections house supercharger, diffuser, accessory-drive gears and mountings.

VALVE GEAR.—Two valves per cylinder. Exhaust valve sodium-filled. Valves actuated by push-rods and rolls-type cam-follower. Shelf-type cams improve service life by reducing deflection.

CARBURATION.—Stromberg PD9F1 carburettor.

LUBRICATION. Dry sump pressure type. Stationary continuous-flow jets lubricate pistons and cylinder walls, improving piston cooling by elimination of detonation.

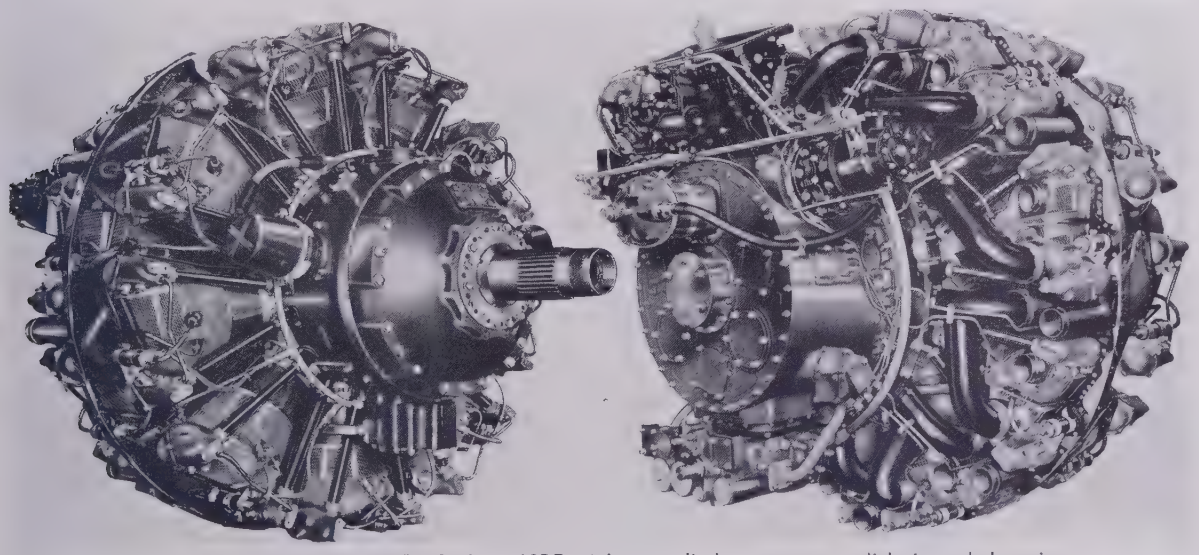
ACCESSORIES.—Bosch SF7LU-2 magnetos, carburettor, priming system accessory drives and covers, cooling air deflectors and baffles, are standard equipment. Torque-meter and inter cylinder air ducts optional.



The 800 h.p. Wright R-1300 Cyclone 7BA engine.

THE WRIGHT R-1300 CYCLONE 7 SERIES.

Engine Model	Take-off Horsepower	Normal Rating (low blower)	Normal Rating (high blower)	Compression Ratio	Blower Ratio	Reduction Gear Ratio	Dry Weight	Fuel Grade
957C7BA1	800 h.p. at 2,600 r.p.m. at 5,500 ft. (1,680 m.)	700 h.p. at 2,400 r.p.m. at 7,300 ft. (2,226 m.)	—	6.2 : 1	7.21 : 1	.5625 : 1	1,055 lbs. (479 kg.)	91/98



The 2,500 h.p. Wright R-3350 Cyclone 18BD eighteen-cylinder two-row radial air-cooled engine.

DIMENSIONS.
Overall diameter 50.45 (1,281 mm.).
Length 48.12 in. (1,225 mm.).
WEIGHTS AND PERFORMANCE.
See Table.

THE WRIGHT R-1820 CYCLONE 9 SERIES.

CYLINDERS.—Bore 6.125 in. (155.6 mm.). Stroke 6.875 in. (174 mm.). Capacity 1,823 cub. in. (29.88 litres). Forged aluminium-alloy heads, "course/fine" finning with a minimum of fins on the forward side and a maximum on the rear side for well balanced cooling. The exhaust-valve seats are of shrunk-in stellite alloy. The cylinder barrel is cooled by K-type inserted aluminium fins with the bottom fin of steel to prevent damage while installing or removing cylinder head hold-down capscrews.

PISTONS.—Forged aluminium-alloy with three oil and two compression rings.

CONNECTING RODS.—H-section single-piece master-rod with steel-backed silver bearing. Eight forged steel articulated rods.

CRANKSHAFT.—Two-piece single-throw forged steel dynamically-dampened shaft supported in roller bearings. Crankshaft strengthened to accommodate higher powers.

CRANKCASE.—Two-piece power section generally similar to others in the C9 Series except for some redesign to accommodate stationary oil-jets. Power section of forged steel-alloy and front and rear sections of cast magnesium alloy.

CARBURATION.—Stromberg PD12K18 carburettor mounted on top of supercharger housing at rear of engine. Supercharger and diffuser redesigned to provide manifold pressure required by higher powers and to improve fuel distribution at higher altitudes.

LUBRICATION.—Dry sump. Stationary oiljets in crankcase for continuous cylinder wall and piston lubrication and cooling.

ACCESSORIES.—Carburettor, two Scintilla SF9LU-2 magnetos, priming system, baffles and air deflectors, accessory drives and covers. Optional equipment includes inter-cylinder cooling ducts, manifold pressure regulator, torquemeter and water ignition equipment.

AIRSCREW DRIVE.—1 : 1, .4375 : 1 or 5625 : 1, Spline size SAE50, Rotation clockwise when viewed from the rear end.

DIMENSIONS.—
Diameter 54.95 in. (1,395 mm.).
Length 49.09 in. (1,247 mm.).

WEIGHTS AND PERFORMANCE.—
See Table.

THE WRIGHT R-3350 CYCLONE 18 SERIES.

TYPE.—Eighteen-cylinder double-row geared and supercharged radial air-cooled.

CYLINDERS.—Bore 6.125 in. (155.6 mm.). Stroke 6.312 in. (160.2 mm.). Capacity 3,347 cub. in. (54.56 litres). Universal-type forged head with "course/fine" finning and increased finning in area of exhaust-valve for improved cooling. Forged head has greater total cooling area than cast type used on earlier C18's. Rocker boxes are slightly smaller than type previously used and are held in place by five studs.

PISTONS.—Tapered interior to accommodate tapered articulated and master-rod ends. Five piston rings, three oil and two compression.

CONNECTING RODS.—Gudgeon-pin end of articulated rods tapered to accommodate maximum thrust on down stroke and lesser thrust on return stroke. Gudgeon-pin and knuckle pin bearings of bronze. Silver master-rod bearing is steel-backed and end-sealed. All rods shot-peened during manufacture.

CRANKSHAFT.—Two-throw forged steel crankshaft dynamically-balanced with single-weight second-order balancers concentric with crankshaft.

CRANKCASE.—Eight-piece crankcase. Power section of forged steel front and rear sections of magnesium-alloy. Front or nose section in two pieces to facilitate maintenance. Reduction gears are "high overlap" type for increased tooth contact. Ball thrust-bearing mounted in front section and roller-main bearings mounted in webs of crankcase power section. Electric torque pressure indicator and provision for double-acting hydraulic airscrew provided in front section.

VALVE GEAR.—Valve seats Stellite-faced and shrunk into aluminium-alloy head. Rocker-arm ratio 1 : 1. Rocker-arms pivot on plain bearings. Push-rods enclosed in tubular housings with gland-type seals.

FUEL METERING.—BA, BD and CA models manufactured with direct fuel-injection. Fuel-injection equipment includes two nine-cylinder pumps, master control, equalizer, bar fuel lines and cylinder injection nozzles. Supercharger impeller is new "inducer" type which improves both efficiency and capacity of impeller. "Siamese" Y-type intake pipes serve two cylinders each. Some CA models inject fuel at supercharger impeller.

LUBRICATION.—Dry sump. Front sump pump scavenges to rear pump which supplies oil at pressure for lubrication. Front sump also has regulator for reduction-gear pressure. Crankcase has stationary oil jets built in.

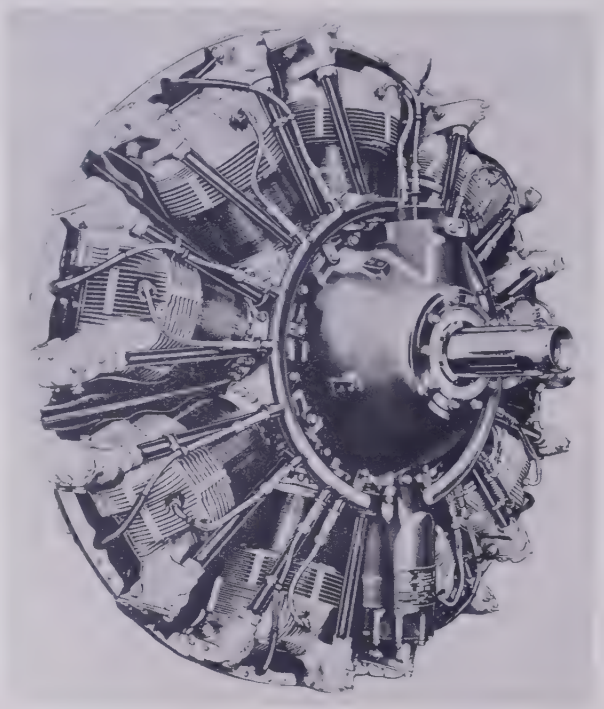
IGNITION.—Either high or low-tension. Low-tension type includes one generator mounted on rear cover, two 18-point distributors mounted on front section and distributing low-tension current to high-tension coil on each cylinder. This system cuts leakage and arcing and eliminates long travel of high-tension current. No supercharging of ignition system necessary for high-altitude flights.

ACCESSORIES.—Rear cover strengthened for mounting of power take-off for cabin supercharging, etc. Double acting airscrew pitch control torquemeter, priming system, fire-seal adapter flange, cooling-airdeflectors, accessory drives and covers, Scintilla magnetos.

OPTIONAL EQUIPMENT.—Manifold pressure regulator, .35, .4375 or .5625 reduction gears, anti-detonant (water injection) equipment.

DIMENSIONS.—
Diameter 55.62 in. (1,413 mm.).
Length (Models 956 and 975) 78.54 in. (1,995 mm.).
Model 749 (fuel injection) 78.52 in. (1,994 mm.).

WEIGHTS AND PERFORMANCE.—
See Table.



The 1,525 h.p. Wright R-1820 Cyclone 9HE engine.

THE WRIGHT TURBO COMPOUND.

The Turbo Compound combines an improved design R-3350 engine and three "blow-down" turbines, each turbine being fed by six short pipes from the cylinder exhaust ports. The turbines, which are equally disposed around the engine on an extension of the rear cover, are in turn geared to fluid drives to the engine crankshaft. This arrangement is claimed to convert into useful power approximately 20 per cent. of the available heat energy normally lost through the engine exhaust.

The engine uses this high velocity exhaust gas to drive an impulse turbine wheel which does work by absorbing some of the velocity energy of the gas without imposing back pressure on the cylinders. The turbines are called "blow-down" turbines because the high velocity of the gases they use comes from the gas blowing down across the exhaust valve. The gases are not sent to a common collector as in the case of the turbo-supercharger, but are conveyed to the turbine wheel through separate pipes.

A complete cooling system is built into each turbine unit. Ram air is picked up by a duct at the cowl seal and is delivered to each turbine assembly. A seven-inch diameter impeller forces this air through holes at the base of each turbine blade into a cooling cap, where it

THE WRIGHT R-1820 CYCLONE 9 SERIES.

Engine Model	Take-off Horsepower	Normal Rating (low blower)	Normal Rating (high blower)	Compression Ratio	Blower Ratio	Reduction Gear Ratio	Dry Weight	Fuel Grade
961C9HE1	1,475 h.p. at 2,800 r.p.m.	1,275 h.p. at 2,500 r.p.m. at 3,500 ft. (1,070 m.)	1,125 h.p. at 2,500 r.p.m. at 10,600 ft. (3,235 m.)	6.80 : 1	7.21 : 1 and 8.69 : 1	.4375 : 1 or .5625 : 1	1,398 lb. (634.7 kg.)	100/130
959C9HE1	1,525 h.p. at 2,800 r.p.m.	1,275 h.p. at 2,500 r.p.m. at 3,500 ft. (1,070 m.)	1,125 h.p. at 2,500 r.p.m. 10,600 ft. (3,235 m.)	6.80 : 1	7.21 : 1 and 8.69 : 1	.4375 : 1 or .5625 : 1	1,398 lb. (634.7 kg.)	115/145
955C9HE1	1,525 h.p. at 2,800 r.p.m. (with water injection)	1,275 h.p. at 2,500 r.p.m. at 3,500 ft. (1,070 m.)	1,125 h.p. at 2,500 r.p.m. at 10,600 ft. (3,235 m.)	6.80 : 1	7.21 : 1 and 8.69 : 1	.4375 : 1 or .5625 : 1	1,413 lb. (634.7 kg.)	100/130

THE WRIGHT R-3350 CYCLONE 18 SERIES.

Engine Model	Take-off Horsepower	Normal Rating (low blower)	Normal Rating (high blower)	Compression Ratio	Blower Ratio	Reduction Gear Ratio	Dry Weight	Fuel Grade
745C18BA1 (Fuel Injection)	2,200 h.p. at 2,800 r.p.m.	2,000 h.p. at 2,400 r.p.m. at 4,800 ft. (1,465 m.)	1,800 h.p. at 2,400 r.p.m. at 18,000 ft. (5,490 m.)	6.5 : 1	6.46 : 1 and 8.67 : 1	.4375	2,670 lb. (1,212 kg.)	100/130
749C18BD1 (Fuel Injection)	2,500 h.p. at 2,800 r.p.m.	2,100 h.p. at 2,400 r.p.m. at 4,400 ft. (1,340 m).	1,800 h.p. at 2,400 r.p.m. at 16,000 ft. (4,880 m.)	6.5 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	2,884 lb. (1,309 kg.)	100/130
956C18CA1 (Fuel Injection)	2,700 h.p. at 2,800 r.p.m.	2,700 h.p. at 2,600 r.p.m. at 6,300 ft. (1,920 m.)	2,000 h.p. at 2,600 r.p.m. at 15,800 ft. (4,820 m.)	6.7 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	2,957 lb. (1,342 kg.)	115/145
975C18CA1 (Fuel Injection	2,800 h.p. at 2,900 r.p.m.	2,400 h.p. at 2,600 r.p.m. at 4,800 ft. (1,465 m.)	2,000 h.p. at 2,600 r.p.m. at 15,700 ft. (4,790 m.)	6.7 : 1	6.46 : 1 and 8.67 : 1	.4375 : 1	3,029 lb. (1,375 kg.)	115/145

passes into the exhaust through an aspirator pipe.

The Turbo Compound may be installed in existing types of aircraft fitted with the standard Cyclone 18 engine. The diameter of the Turbo Compound is similar to that of the Cyclone 18 and the overall length is increased by only a few inches, so that the new engine fits within the cowling lines of existing installations with a minimum of modification.

Tests conducted by the Wright Corporation indicate that a given aircraft powered with the new Turbo Compound engine can (*a*) fly 20 per cent. further for the same fuel consumption than it can if equipped with the conventional type ; or (*b*) operate the same range with 20 per cent. less fuel.

The following are some of the pertinent characteristics of the Turbo Compound engine :—

Commercial Designation. — 972TC18DA-1 and -2.

Cylinders.—Bore 6.125 in. (155.6 mm.). Stroke 6.312 in. (160.2 mm.). Capacity 3,350 cub. in. (54.56 litres). Compression ratio 6.7.

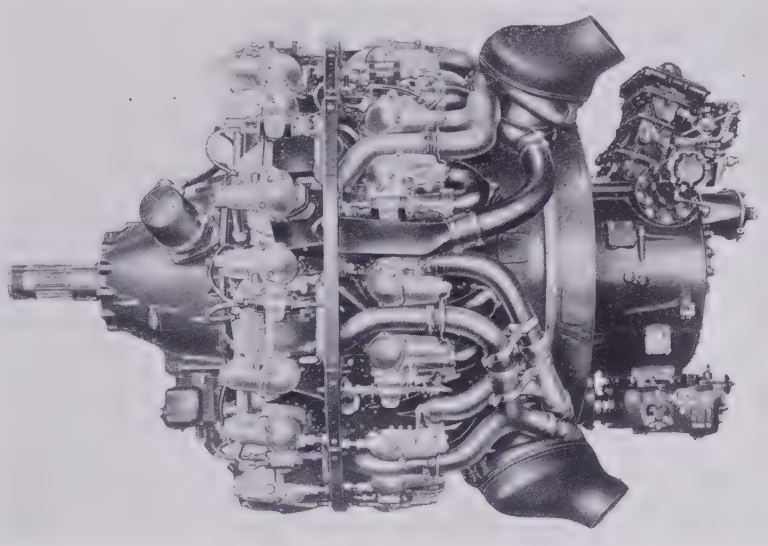
Blower Ratios.—6.46 and 8.67 : 1.

Airscrew Reduction Gear Ratio.—O-4375 : 1.

Fuel Grade.—115/145.

Diameter (without cowling).—56.6 in. (1,438 mm.).

Dry Weight.—3,514 lb. (1,595 kg.).



The 3,350 h.p. Wright Turbo-Cyclone 18 engine.

Performance.—

Max. T.O. output over 3,500 h.p. at 2,900 r.p.m.

Normal cruise output (71% power) 1,910 h.p. at 2,400 r.p.m. at 11,400 ft. (3,480 m.) low blower.

Consumptions.—

Guaranteed fuel consumption (static) 0.391 lb./h.p./hr. (0.177 kg./h.p./hr.) at 50% power.

Max. oil consumption 33 lb./hr. (15 kg./hr.) at 89% of rated speed.

THE WORLD'S AIRSHIPS

(CORRECTED TO AUGUST 31st, 1953)

GREAT BRITAIN

A small non-rigid airship of 45,000 cub. ft. has been built by The Airship Club under the direction of Lord Ventry, and with the financial assistance of the Bournemouth Corporation and the Air League of the British Empire.

The car, control surfaces and other mechanical parts were made at the Hurn Airport, near Bournemouth, and the envelope was made and fitted out by the R.F.D. Company, Ltd. at Godalming, Surrey. The ship was assembled at the R.A.F. Station, Cardington, from which it made its maiden flight on July 19, 1951.

The control car, which has accommodation for four, has a steel tube framework and is covered forward and above with transparent panels and elsewhere with light alloy sheet. The engine, a 75 h.p. Salmson nine-cylinder radial, is mounted aft and drives a four-blade propeller. The main envelope is hydrogen-filled and there are two ballonets which have a total capacity of 5,000 cub. ft.

The "Bournemouth" made three flights in 1951 and except for the planes which were too small to give efficient control, she behaved well. A new set of planes was made at the de Havilland Aeronautical and Technical School at Hatfield and on September 8, 1952, the "Bournemouth" was again flown from Cardington.



The non-rigid airship "Bournemouth" (75 h.p. Salmson engine).

The ship is now in process of reconstruction, during which a different engine may be fitted, as it is feared that the Salmson engine may run too hot as a pusher at sustained high r.p.m. It is expected that the reconstructed "Bournemouth" will be ready to fly again in the Summer of 1954.

DIMENSIONS.—
Length 108 ft. 6 in. (33 m.).
Diameter 27 ft. 3 in. (8.3 m.).
Volume 45,000 cub. ft. (1,275 m.³).

WEIGHTS.—
Weight empty approximately 1,820 lb. (826 kg.).
Useful lift at 68 lb. (30.8 kg.) per 1,000 cub. ft. (28.3 m.³) approximately 1,240 lb. (563 kg.).

FRANCE

SOCIÉTÉ ZODIAC.

HEAD OFFICE AND WORKS: 15, AVENUE DE LA DIVISION-LECLERC, PUTEAUX (SEINE).

The most recent lighter-than-air product of the Société Zodiac is a light airship which is a modern development of the motor-balloon. It was originally supplied to the Pernelle Wool Company by whom it was used for advertising purposes. It is now owned by the Société St. Raphaël.

The motor-balloon originated in France in the late thirties when the Société Zodiac was requested by the Army authorities to convert an ordinary standard kite-balloon into a powered balloon to provide mobility. The kite-balloon envelope was provided with a self-contained nacelle, carrying engine and elevator surfaces and providing accommodation for a crew of two. The change-over from kite-balloon to motor-balloon and *vice-versa* could be made in under ten minutes. A small series of these balloons was delivered to the French Army before the war.

The St. Raphaël Zodiac has no ballonets, the envelope expanding against elastic cords. Its volume may therefore vary from 820 m.³ (29,650 cub. ft.) to 1,020 m.³ (36,100 cub. ft.). It is powered by a 60 h.p. Salmson radial air-cooled engine which drives a two-blade tractor airscrew. With a crew of two, it has a maximum speed of about 67.2 km.h. (42 m.p.h.) and an endurance of 5 hours.



The St. Raphaël Zodiac motor-balloon (60 h.p. Salmson engine).

The ship has flown for some 500 hours and operates entirely from a mooring mast. Belly mooring is used and has proved quite satisfactory in winds up to 40 m.p.h. (64 km.h.) on the ground.

DIMENSIONS.
Length 31.8 m. (104 ft. 5 in.).
Diameter 7.7 m. (25 ft. 6 in.) expanding to 8.5 m. (28 ft. 2 in.) against elastic cords.
Volume 820-1,020 m.³ (29,650-36,100 cub. ft.).

UNITED STATES OF AMERICA

GOODYEAR

THE GOODYEAR AIRCRAFT CORPORATION.

HEAD OFFICE AND WORKS : AKRON 16, OHIO.

President : P. W. Litchfield.

Vice-President and General Manager : T. A. Knowles.

Vice-President in charge of Engineering : Dr. Karl Arnstein.

Secretary : G. F. Clayton.

The Goodyear Aircraft Corpn. was formed on December 5, 1939, to take over from the parent Goodyear organization its principal manufacturing operations in the field of aeronautics, with the exception of tyres, inner tubes, bullet-proof fuel tanks and other rubber accessories. This also included the activities of the former Goodyear-Zeppelin Corpn., then mainly devoted to lighter-than-air craft.

During the war the Corporation was engaged in the manufacture of airships, aircraft, aircraft components and sub-assemblies. In the lighter-than-air field Goodyear fulfilled for the U.S. Navy a programme of upwards of 200 airships ranging from the L-type trainers of 123,000 cub. ft. (3,480 m.^{3}) capacity to the K and M patrol ships having a helium gas capacity of 456,000 cub. ft. (12,905 m.^{3}) and 725,000 cub. ft. (20,520 m.^{3}) respectively. After the completion of the airship programme in April, 1944, the activities of the Corporation were devoted solely to the production of aircraft, parts and sub-assemblies as well as the manufacture of Goodyear wheels, brakes and other specialised components.

To-day, the Goodyear Aircraft Corpn. continues its role as the sole supplier of airships to the U.S. Navy's lighter-than-air section. A new patrol ship, known as the N-1 was test-flown in 1951 and was delivered to the U.S. Navy in 1952.

The new N Class ship has a helium capacity of 875,000 cub. ft. (24,500 m.^{3}). It is powered by two 800 h.p. Wright R-1300-2 radial air-cooled engines mounted in an engine room within the car and driving through shafts and gearing two 18 ft. (5.49 m.) Curtiss Electric three-blade controllable-pitch, feathering and reversible propellers mounted on outriggers projecting from each side of the car.

The control car, which accommodates a crew of fourteen officers and ratings, has two decks, with all operational stations on the lower deck and crew's quarters on the upper deck.



The Goodyear G Class Advanced Training Airship.



A Goodyear K type Airship used for advertising purposes.



The Goodyear L Class Training Airship, now no longer in service.



The Goodyear N-1 (two 800 h.p. Wright Cyclone engines), the largest non-rigid airship so far built.

A tricycle landing-gear comprising a nose wheel and two larger wheels, one under each propeller outrigger, is retractable.

The four control surfaces on the stern of the ship are mounted at 45 degree angles from the vertical and horizontal and as all surfaces are operated in unison for either vertical or horizontal control they are known collectively as "rudde-vators."

Special equipment will permit the N ship to refuel in flight from a surface craft or to re-ballast through a water pick-up system. Air/Sea Rescue equipment includes an hydraulically-operated winch to haul survivors aboard.

The ship's envelope is made of Neoprene-coated Fortisan rayon and the control car is constructed of a sandwich material comprising a balsa wood core faced with aluminium-alloy sheet.

The N ship has an overall length of 324 ft. 5 in. (99 m.), a height of 94 ft. 5 in. (28.8 m.) and a width of 73 ft. 6 in. (22.4 m.). The car length is 83 ft. (25.3 m.) long. The maximum gross weight is 53,000 lb. (24,000 kg.) and the useful load will exceed 6½ short tons (5,900 kg.). The designed maximum speed is 75 knots (139 km.h.).

The U.S. Navy continues to maintain a number of airships in commission for training and as a nucleus of a lighter-than-air anti-submarine and convoy escort forces. These include ships of the G, K and M classes, all built by Goodyear.



The Goodyear M Class Long-endurance Patrol Airship.

Many of the wartime K-type ships have been modified to bring them as near as possible into line with present-day requirements for intermediate-range anti-submarine patrol ships. These modernised ships are, according to equipment, etc., known by the designations P2K and P3K. An entirely new K-type ship, the P4K, is under construction for the U.S. Navy by Goodyear.

The Goodyear company also has a number of small airships under civil registration in service, the majority being based at Wingfoot Lake, Akron, Ohio.

GOODYEAR AIRSHIPS BUILT FOR THE U.S. NAVY.

Class	Volume	Length	Max. Diameter	Engines	Max. Speed m.p.h. (km.h.)	Remarks
G	196,700 cub. ft (5,570 m.³)	192 ft. (58.7 m.	45 ft. (13.7 m.)	2×220 h.p. Wright Whirlwind	about 63 m.p.h. (91 km.h.)	Used as advanced trainers and for experimental purposes by U.S. Navy. First G ship built in 1936. Seven more built during last war.
K	527,000 cub. ft. (12,910 m.³)	253 ft. (77 m.).	60 ft. 18.3 m.)	2×550 h.p. Pratt & Whitney Wasp	over 75 m.p.h. (120 km.h.)	Standard U.S. Navy patrol ship. First K ship launched on December 8, 1938. 130 built during last war. U.S. Navy has modified and is continuing to modify many K ships to P2K and P3K standards with latest electronic equipment and increased power (550 h.p. Pratt & Whitney Wasp engines).
M	725,000 cub. ft. (20,520 m.³)	310 ft. (94.5 m.)	68.3 ft. (20.8 m.)	2×550 h.p. Pratt & Whitney Wasp	over 75 m.p.h. (120 km.h.)	U.S. Naval long endurance patrol ship. A PM-1 ship is holder of World's Duration Record of more than one week of sustained flight. Early PM-1 ships powered by 550 h.p. Pratt & Whitney Wasps. Later P3M ships have 2×700 h.p. Wright Cyclones.
N	875,000 cub. ft. (24,760 m.³)	324.4 ft. (98.8 m.)	73.5 ft. (22.4 m.)	2×800 h.p. Wright R-1300 Cyclone	over 85 m.p.h. (136 km.h.)	First PN-1 completed in 1951. An undisclosed number of P2N ships (975,000 cub. ft. volume) on order for U.S. Navy.

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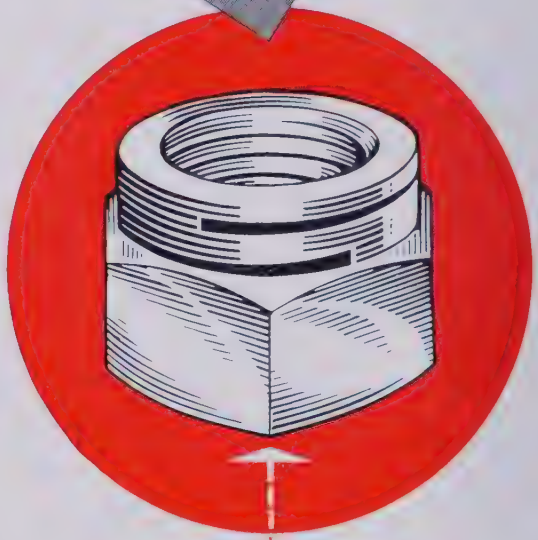
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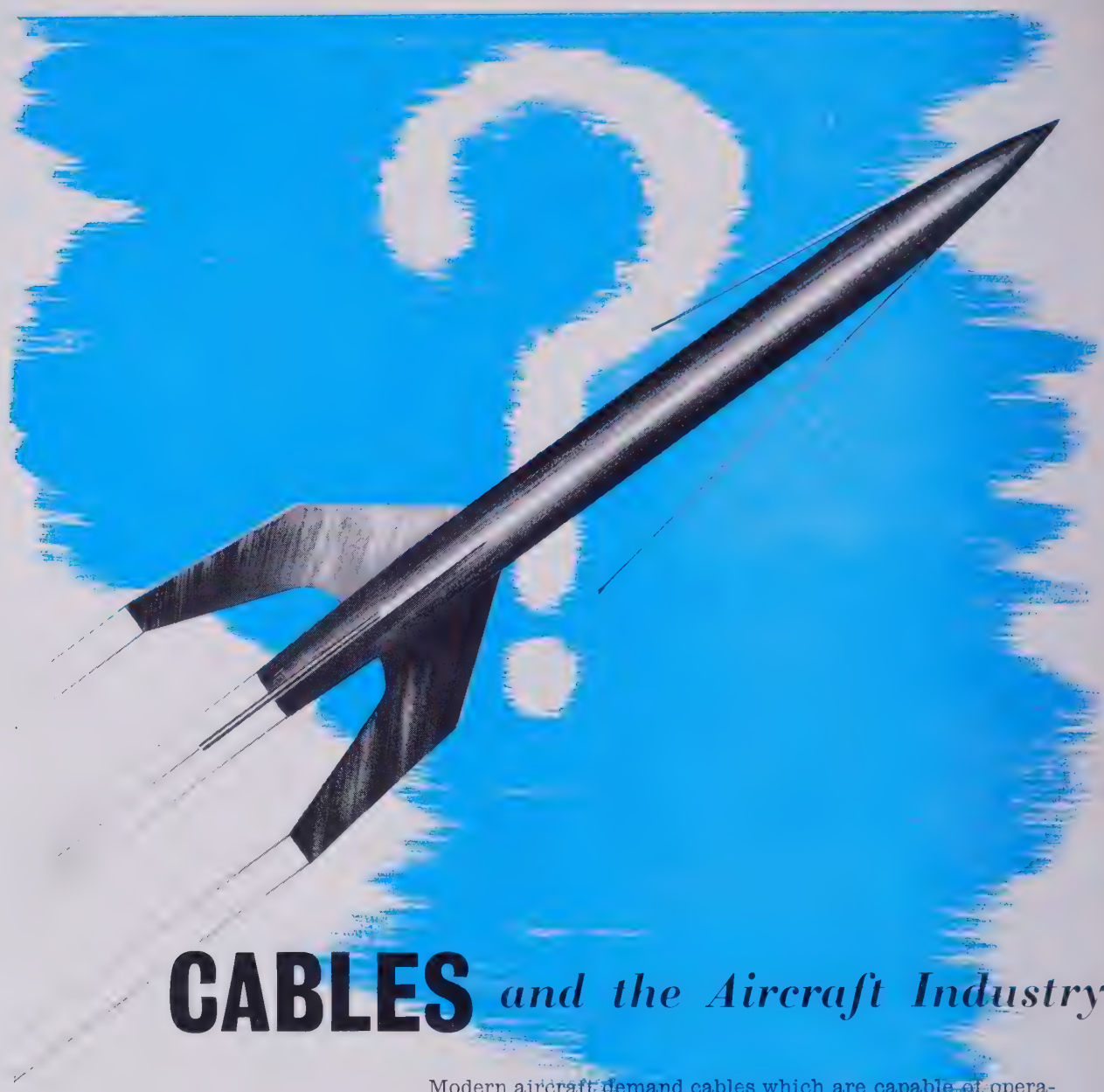
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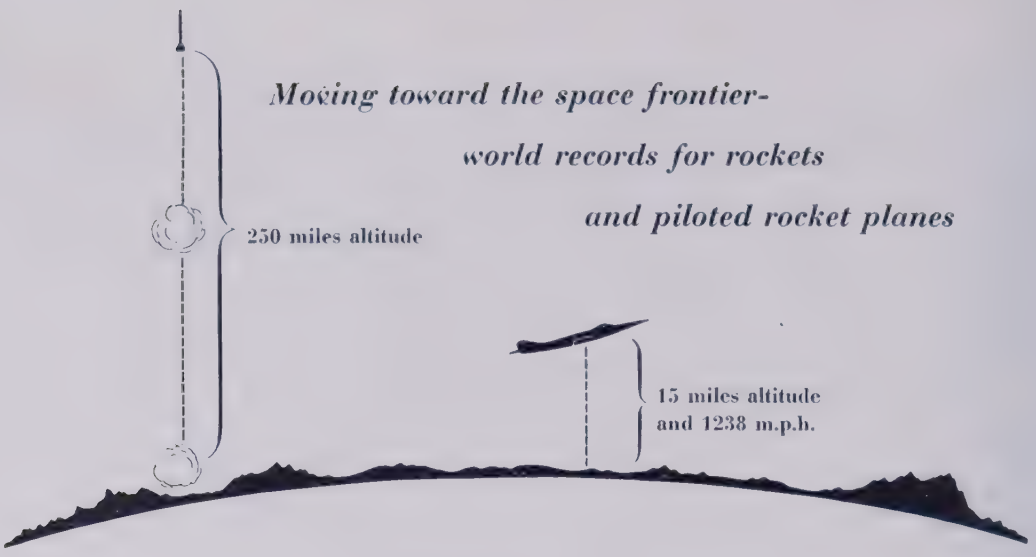
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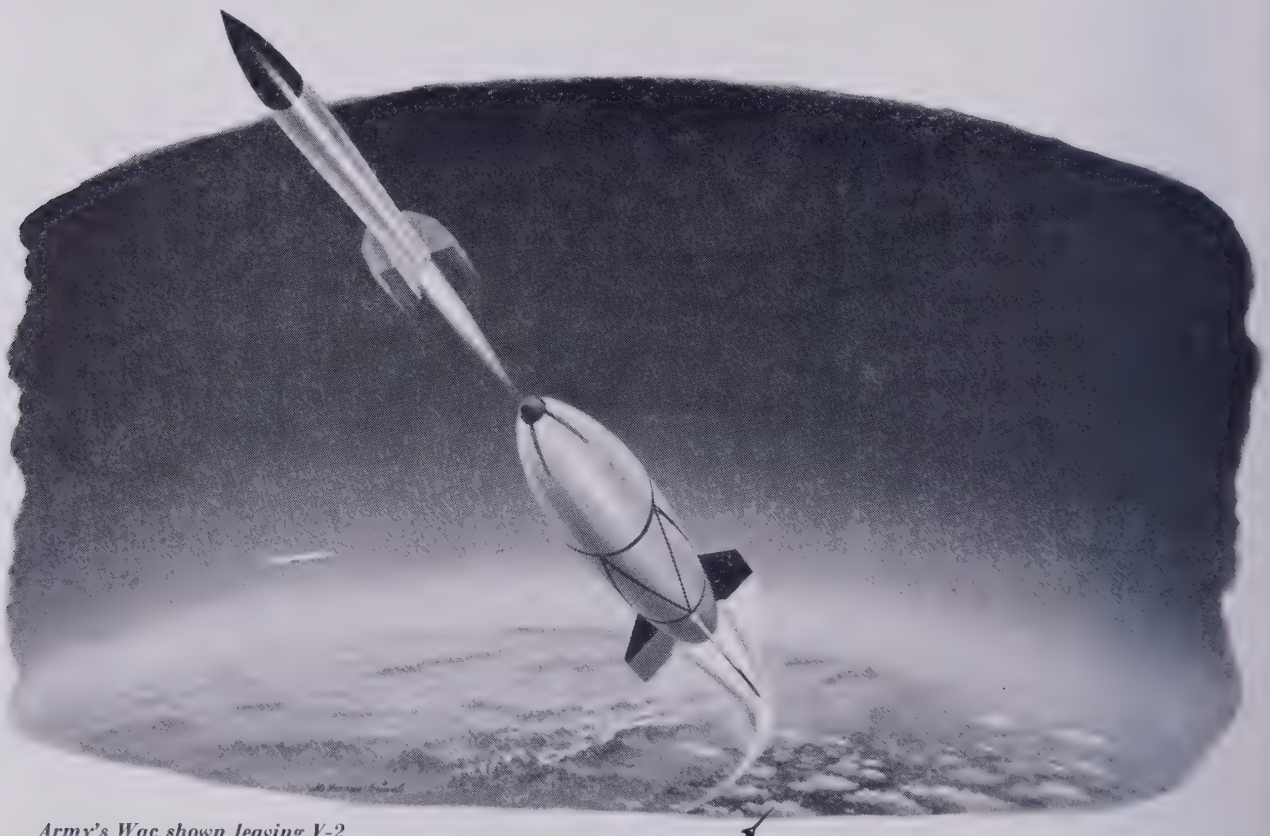
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THREE POINTERS...

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The tanker refuelling unit is being designed as a "pack" to enable rapid installation in any suitable bomber or transport aircraft. With the right approach, a bomber can be converted to a tanker in thirty minutes.

Probe and Drogue flight-refuelling provides a safe, simple and economical method of increasing the range and striking power of aircraft. Its possible applications to fighters, bombers, ocean patrol aircraft, and virtually all operational types, are many and varied.

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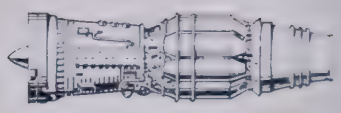
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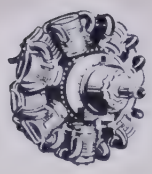
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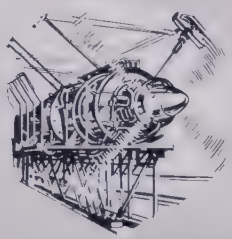
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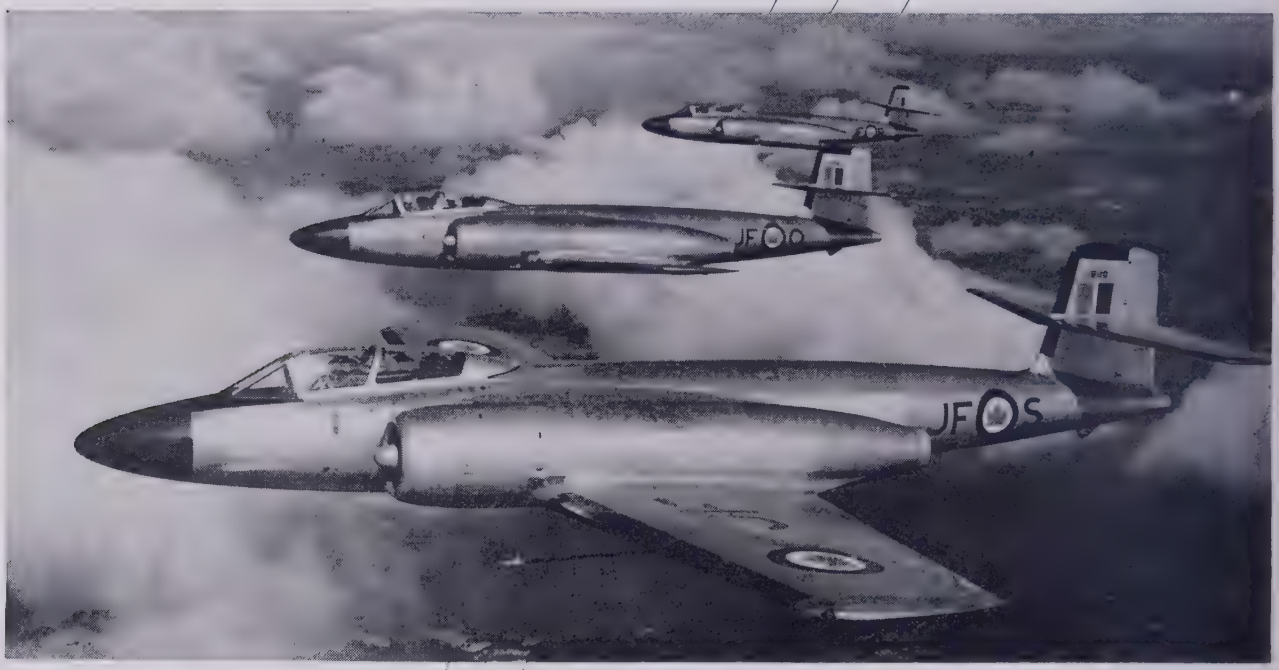
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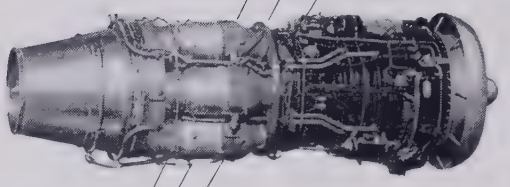
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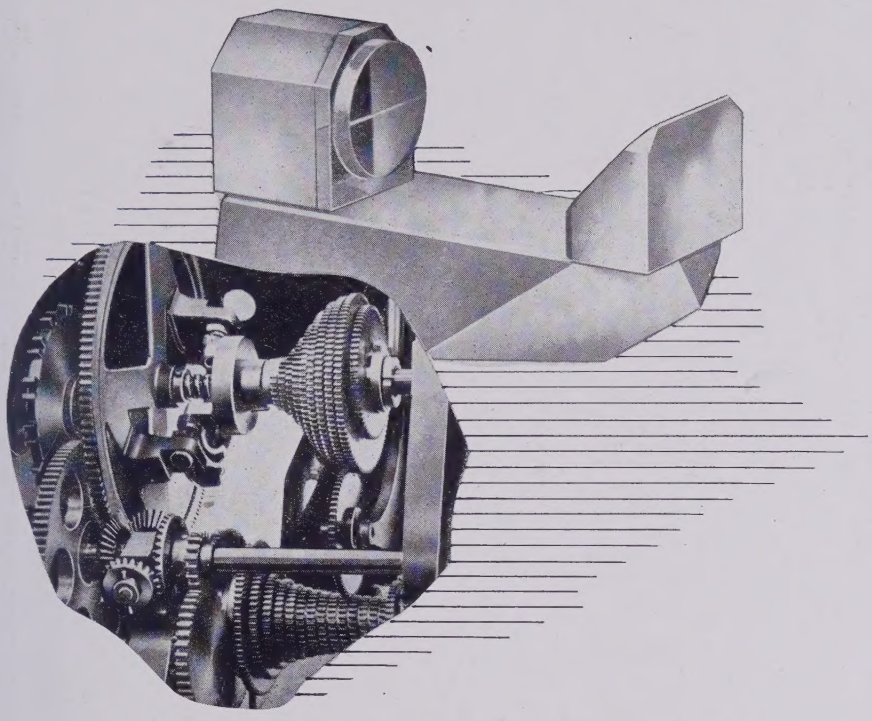
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